

SUGGESTED GUIDE AND CHECKLIST  
FOR AN  
OPERATION AND MAINTENANCE MANUAL  
FOR  
PUBLIC WATER TREATMENT FACILITIES

Prepared by  
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MARCH 1991

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MAINTENANCE MANUAL FOR PUBLIC WATER TREATMENT FACILITIES

TABLE OF CONTENTS

CHAPTER I. INTRODUCTION

Manual User Guide - Table of Contents

- A. Operation and managerial responsibility
  - 1. Operator responsibility
    - a. General - outline responsibilities
      - (1) Know proper operational procedures
      - (2) Keep accurate records
      - (3) Properly manage operating funds
      - (4) Keep supervisors informed
      - (5) Keep informed of current O & M practices
    - b. List short courses and operator schools available
    - c. Provide suggested list of journals/periodicals related to municipal water treatment
  - 2. Treatment system management responsibility - outline responsibilities
    - a. Maintain efficient plant operation and maintenance
    - b. Maintain adequate records
    - c. Establish staff requirements, prepare job descriptions and assign personnel
    - d. Provide good working conditions
    - e. Establish operator training program
    - f. Provide incentives for employees
    - g. Maintain good public relations
    - h. Prepare budgets and reports
    - i. Plan for future facility needs
    - j. Develop standard operating procedures
- B. Type of treatment and treatment requirements
  - 1. Type treatment - Describe major process
    - a. Preliminary - bar screens, etc.
    - b. Pre-treatment - aeration, oxidation, pre-sedimentation, etc.
    - c. Primary treatment - rapid mix coagulation, flocculation, sedimentation, filtration, disinfection.
    - d. Post treatment, disinfection, corrosion control, fluoridation, etc.
  - 2. Treatment requirements / water quality standards
    - a. Turbidity
    - b. Disinfectant residual / by-products
    - c. Chemical balance / corrosion control
    - d. Coliform bacteria / microbiological
    - e. Virus, giardia, legionella
    - f. Inorganics / organics / voc / radionuclides

- g. Secondaries / lead
  - h. Nitrate
- C. Description of plant type and flow pattern
- 1. Plant type - briefly describe individual units
    - a. Preliminary treatment
    - b. Pretreatment
    - c. Primary treatment
    - d. Post treatment
    - e. Disinfection
    - f. Sludge handling / wastewater disposal
  - 2. Flow Pattern
    - a. Include a basic flow diagram
  - 3. Provide copy of well head protection program for groundwater supplies
  - 4. Provide copy of reservoir protection program for supplies using impoundments.

## CHAPTER II. PERMITS AND STANDARDS

- A. Water withdrawal permit and permit requirements
- 1. Give withdrawal permit number / give pwsid number
  - 2. Give renewal date if applicable
  - 3. List permit requirements / water quality standards
  - 4. Include permit application guidelines
  - 5. Copy of state agency regulations dealing with wastewater discharge permits should be included or copy of KPDES permit

## CHAPTER III. DESCRIPTION, OPERATION AND CONTROL OF WATER TREATMENT FACILITIES

- A. General - Each major water treatment unit/process should be discussed separately with respect to the following considerations:
- 1. Description
    - a. Provide a brief general description with each major treatment unit/process discussed
      - (1) Preliminary treatment
      - (2) Pretreatment
      - (3) Primary treatment
      - (4) Post treatment
      - (5) Disinfection
      - (6) Sludge handling / wastewater disposal
    - b. The description should physically treat the water through the unit/process and comment on design efficiency

2. Relationship to adjacent units
    - a. Give type and function of any or all preceding units/processes as they relate to unit/process being considered
    - b. Give type and function of any or all following units/processes being considered
  3. Classification and control
    - a. Classification - briefly describe relation to similar units/processes
      - (1) Standard / conventional
      - (2) Modified
      - (3) Other
    - b. Control - give methods of controlling unit-process
      - (1) Flow to plant
      - (2) Coagulant dosage / chemical balance
      - (3) Disinfection
      - (4) Filter backwash procedures
      - (5) Sludge wasting / disposal rates
      - (6) Other (physical and process controls) ie. taste/odor control, color removal
      - (7) Fluoridation
  4. Major components
    - a. List all components within the unit/process
    - b. List all major mechanical equipment items within the unit/process
  5. Common operating problems
    - a. State problems that might occur in unit/process
    - b. List probable causes
    - c. Discuss control/prevention techniques
  6. Laboratory Controls
    - a. List tests and give expected ranges for test results
    - b. Give relation between test results and treatment unit/process operation
    - c. Provide sampling points/frequency
  7. Start-up - give start-up techniques
- B. Specific Plant Operation
1. Normal Operation
    - a. Discuss the normal operation of each unit/process
  2. Alternate Operation
    - a. List alternate modes of operation
    - b. Provide discussion and schematics to illustrate alternate operations

#### Chapter IV. DESCRIPTION, OPERATION AND CONTROL OF SLUDGE HANDLING FACILITIES

- A. Specific plant operation
  - 1. Normal operation
    - a. Discuss the normal operation of each unit/process
  - 2. Alternate operation
    - a. List alternate modes of operation
    - b. Provide discussion and schematics to illustrate alternate operations

#### CHAPTER V. PERSONNEL

- A. Manpower Requirements/Staff - List personnel required
  - 1. Supervisors
  - 2. Administrative
  - 3. Operational
  - 4. Maintenance
- B. Qualifications
  - 1. For each job title give:
    - a. Training
    - b. Experience
    - c. Skills required
    - d. License/certificate required.
- C. Certification program
  - 1. Include copy of State Certification Boards's Rules and Regulations
  - 2. Discuss pertinent aspects of operator certification as they apply to the facility at hand

#### CHAPTER VI. LABORATORY TESTING

- A. Purpose - discuss purpose of laboratory testing
  - 1. Essential to treatment process control
  - 2. Provides an operating record for treatment system
  - 3. Aids in problem analysis and prevention

B. Sampling

1. Give sampling locations
2. Give sampling frequency
3. Outline a sampling program for the treatment system

C. Laboratory References - List pertinent references

1. Standard Methods for the Examination of Water and Sewage
2. Other

D. Interpretation of Laboratory Tests - give brief definition and sanitary engineering application for all tests

1. Turbidity
2. Temperature
3. pH
4. Alkalinity
5. Hardness
6. Carbon Dioxide
7. Total Dissolved Solids
8. Langelier Index
9. Chlorine residual
10. Fluoride
11. Other / Color / Taste / Odor

E. Sample Laboratory Worksheets - give instructions for completing sample forms

CHAPTER VII. RECORDS

A. Process Operations/Daily Operating Log - provide sample form and discuss features

1. Weather conditions
2. Facility flow
3. Raw water quality
4. Finished water quality
5. Sludge handling data
6. Status of unit treatment process
7. Operators on duty
8. Complaints received
9. Plant visitors
10. Power consumption
11. Chemicals used
12. Unusual conditions (Operations and maintenance)
13. Routine operational duties performed

B. Laboratory - Comprehensive discussion of laboratory records should be included under laboratory controls chapter of manual

- C. Monthly Report to State Agencies
  - 1. Provide sample form
  - 2. Give instructions for completing form
  - 3. Outline techniques for maximum utilization of state forms to eliminate using any supplemental forms
  - 4. Tell when and where to submit completed forms
  - 5. Designate individual responsible for preparing and signing report
- D. Maintenance - Comprehensive discussion of maintenance records should be included under maintenance chapter of the manual
- E. Operating Cost and Record Keeping - list and discuss each major cost group and record keeping procedure for each
  - 1. Labor
    - a. Operation
    - b. Administration
    - c. Maintenance
  - 2. Utilities
    - a. Electricity
    - b. Fuel oil / optional
    - c. Potable water
    - d. Telephone
    - e. Other
  - 3. Chemicals (Process only)
    - a. Lime
    - b. Alum
    - c. Chlorine
    - d. Other
  - 4. Supplies
    - a. Laboratory chemicals
    - b. Cleaning materials
    - c. Maintenance materials
    - d. Other expendable items
- F. Personnel Records
- G. Emergency Conditions Record

## CHAPTER VIII. MAINTENANCE

### A. General

1. State purpose of maintenance system
2. Outline scope of recommended maintenance system
3. List basic features
  - a. Equipment record system
  - b. Planning and scheduling
  - c. Storeroom and inventory system
  - d. Maintenance personnel
  - e. Cost and budgets for maintenance operations

### B. Equipment Record System

1. Describe equipment numbering system
2. List equipment catalogs
3. Discuss the type information and equipment data which should be maintained
4. Provide instructions on preparing and filing information in the record system
5. Describe data retrieval system
6. Provide completed equipment nameplate data cards for each item of equipment
7. Other

### C. Planning and Scheduling

1. Provide guidelines for preventive maintenance and corrective maintenance tasks
2. Describe schedule chart board
3. Outline work order system
  - a. Provide sample forms
  - b. Describe work order log
4. Discuss contract maintenance work
5. Other

### D. Storeroom and Inventory System

1. Recommend spare parts/components to be maintained
2. Outline stockroom inventory procedures
  - a. Numbering system for all items
  - b. Sample withdrawal slip
  - c. Maximum/minimum quantities to be maintained
  - d. Record system
3. Discuss purchase orders
4. Other



- E. Maintenance Personnel
  - 1. Discuss importance of separation of maintenance costs
    - a. Preventive maintenance
    - b. Corrective maintenance
    - c. Major repairs or alterations
  - 2. Suggest a cost accounting system for storeroom stock, special purchase items and man-hours
  - 3. Other
  
- G. Miscellaneous Maintenance Records
  - 1. Provide sample preventive/corrective maintenance log
  - 2. Give breakdown report format
  - 3. Other
  
- H. Housekeeping - discuss housekeeping activities
  - 1. Yard work
  - 2. Painting
  - 3. General cleaning
  - 4. Other
  
- I. Special Tools and Equipment
  - 1. Outline tool room procedures
    - a. Tool inventory
    - b. Tool check control system
  - 2. Discuss use of tool boards
    - a. Special/frequently used tools
    - b. Location of boards
  - 3. Give maintenance skills required for all special tools
  
- J. Lubrication
  - 1. Give lubrication specifications
  - 2. Provide interchangeable lubricants charts
  - 3. Discuss use of color coded lubrication tags for all equipment
  - 4. Give sample consumption/inventory records
  - 5. Outline sample lubrication route
  
- K. Major Equipment Information
  - 1. List all major equipment items
  - 2. Outline basic maintenance considerations for all major electrical and mechanical equipment items
  - 3. Outline procedure for ordering parts/components or new items

L. Warranty Provisions

1. List all guaranteed equipment
2. Give guarantee period for each piece of equipment
3. Discuss pertinent features of each guarantee

M. Contract Maintenance

1. Provide list of suggested contract jobs
2. Provide list of suggested contractors

CHAPTER IX. EMERGENCY OPERATING AND RESPONSE PROGRAM

- A. Give results of vulnerability analysis of system
- B. List methods to reduce system vulnerability
- C. List mutual aid agreements
- D. Include emergency equipment inventory
- E. Give method of preserving treatment system records
- F. Give coordinating instructions for local police and fire departments
- G. Define responsibilities of treatment system personnel
- H. Designate an emergency response center
- I. List auxiliary personnel requirements
- J. Provide a mechanism for ensuring plan is updated periodically

Chapter X. SAFETY

A. General

1. Management's responsibility - discuss responsibilities
  - a. Communicate safety information to employees
  - b. Eliminate hazardous working conditions
  - c. Motivate employees to be safety minded
  - d. Other
2. Emergency telephone number - provide a list of all numbers
  - a. Hospital
  - b. Fire station
  - c. Ambulance service

- d. Chlorine supplier
- e. State Environmental Emergency (502) 564-2380
- f. Other

B. Electrical Hazards

- 1. Discuss grounding of electric tools
- 2. Outline first aid for electric shock victim
- 3. Designate authorized personnel to perform electrical repairs
- 4. Other

C. Mechanical Equipment Hazards

- 1. Discuss equipment guards
- 2. Discuss notice level considerations
- 3. Designate authorized personnel to perform mechanical repairs
- 4. Other

D. Explosion and Fire Hazards

- 1. Discuss storage of flammable materials
- 2. Give type and location of fire extinguishers
- 3. Discuss use of flammable vapor detectors
- 4. Other

E. Bacterial Infections (Health Hazards)

- 1. State policy on tetanus shots
- 2. Outline personal hygiene considerations
- 3. State policy on care of cuts and other injuries
- 4. Other

F. Chlorine Hazards

- 1. Discuss cylinder handling
- 2. Outline procedure for testing for and responding to leaks
- 3. Describe self-contained breathing apparatus use
- 4. Other

H. Laboratory Hazards

- 1. Discuss volatile materials handling
- 2. Describe protective clothing and devices

3. Discuss proper ventilation
4. Other

I. Safety Equipment - list safety equipment required

1. First aid kits
2. Fire extinguishers
3. Gas masks/air packs
4. Protective clothing and hard hats
5. Safety harnesses
6. Other

K. Process Chemical Handling - discuss procedures for all chemicals used

1. Alum
2. Lime
3. Ferric Chloride
4. Ferrous Sulfate
5. Fluoride
6. Polymer
7. Carbon
8. Caustic Soda
9. Other

L. References - list pertinent safety references

1. Manual of Instruction for Water Treatment Plant Operators
2. American Water Works Association Water Distribution Training Handbook
3. Training Manuals for Large Water Plant Operators
4. Training Manual for Small Water Plant Operators
5. Other

## CHAPTER XI. UTILITIES

A. General

1. Give name of utility company
2. List contact men within utility company
  - a. Routine contact
  - b. Emergency contact
3. Discuss reliability of service
4. Give any cost information available

B. Electrical

1. Give voltage of service adjacent to facility
2. Give reduced voltage entering facility
3. Discuss stand-by power from a second source

C. Telephone

1. Outline telephone communications system within treatment system
2. Discuss only alarm systems that utilize telephone wires

D. Natural Gas

1. Give cubic feet of gas per hour
2. Give normal operating pressure
3. Give size of gas line

E. Water

1. Give size of waterline
2. Give normal operating pressure
3. Discuss any backflow preventer/prevention systems present

F. Fuel Oil

1. List capacities of storage tanks
2. Outline program to insure adequate supplies of fuel oil are always on hand
3. List potential suppliers

CHAPTER XII. ELECTRICAL SYSTEM - Describe the electrical system

A. General

1. Schematic diagrams
2. Tables
3. Manufacturer's literature
4. Shop drawings
5. Designer's notes

B. Power Source

1. Give name of electrical utility company
2. Give characteristics of primary distribution line
3. Describe main transformer and state ownership
4. Discuss protective devices
5. Give maximum available short-circuit current at point(s) of service from utility company

C. Power Distribution System

1. Describe service entrance equipment
2. Describe motor control centers and control panels
3. Provide tabulation indicating power wiring from and loads fed by major electrical components

D. Control and Monitoring System

1. Provide tabulation of type controls present and process equipment involved
2. Provide schematic diagrams

E. Alternate Power Source

1. Describe power source
2. Describe any duplicate equipment in the power distribution system.

APPENDICES

A. Schematics - provide as required

1. Basic flow diagrams
2. Process flow sheets
3. Other

B. Valve Indices - describe all major valves

1. Function
2. Type/size
3. Location
4. Identification

C. Sample Forms - provide as required

1. Daily operating log
2. Equipment data cards
3. Maintenance work order
4. Purchase order
5. Accident report form
6. State reports
7. Other

D. Chemicals Used in Plant

1. List all chemicals
2. Give safety precautions and outline storage considerations in Safe Chapter of Manual
3. List suppliers
4. Provide reorder schedule

- E. Chemicals Used in Laboratory
  - 1. Give common name
  - 2. Give chemical formula
  - 3. List suppliers
- F. Emergency Operating and Response Program - provide as required
  - 1. Schematic diagrams
  - 2. Sample forms
- G. Detailed Design Criteria - tabulate criteria
  - 1. Population served
  - 2. Raw water volume/quality
    - a. Present/future
    - b. Domestic
    - c. Industrial
  - 3. Unit sizes and capacities
  - 4. Hydraulic loadings
  - 5. Detention times
  - 6. Pumping characteristics
  - 7. Sludge treatment and disposal data
- H. Equipment Suppliers
  - 1. Give name
  - 2. List equipment furnished
  - 3. Give reference to where detail information on representatives can be found in manual
- I. Manufacturer's Manuals
  - 1. May be bound separately
  - 2. Manuals should give adequate operating and maintenance instructions
  - 3. Manuals should be indexed/cross-referenced
- J. Sources for Service and Parts
  - 1. List service organizations for all equipment
  - 2. List local repair services
    - a. Meter repair
    - b. Motor rewinding
    - c. Other
  - 3. List local parts sources
    - a. Plumbing wholesalers
    - b. Electrical wholesalers
    - c. Mill supply houses
    - d. Other

- K. As-Built Drawings
  - 1. Ensure drawings are complete and accurate
  - 2. Cross-reference with shop drawings
- L. Approved Shop Drawings
  - 1. Index adequately
  - 2. Cross-reference with engineering drawings and construction specifications.
- M. Dimension Prints
  - 1. Provide when necessary to show units relation to other units, adjacent walls, etc.
  - 2. Use to tie shop drawings to engineering drawing
- N. Construction Photos
  - 1. Label and date all photos
  - 2. Outline photo indexing system
- O. Warranties and Bonds
  - 1. Provide copies
  - 2. Index properly
- P. Copies of State Reporting Forms- provide as required
  - 1. Monthly Operating Report
  - 2. Bypass Report
  - 3. Chlorine Failure Report
  - 4. Other
- Q. Piping Color Codes
  - 1. List color for each piping system
  - 2. State if directional flow arrows and/or labeling required
- R. Painting
  - 1. Give type coating required for each unit
  - 2. Give painting frequency schedule
  - 3. Provide a copy of "Paints and Protective Coating"



