O&M Manuals:
An Essential for Management & Compliance

Drinking Water Partners Spring Training

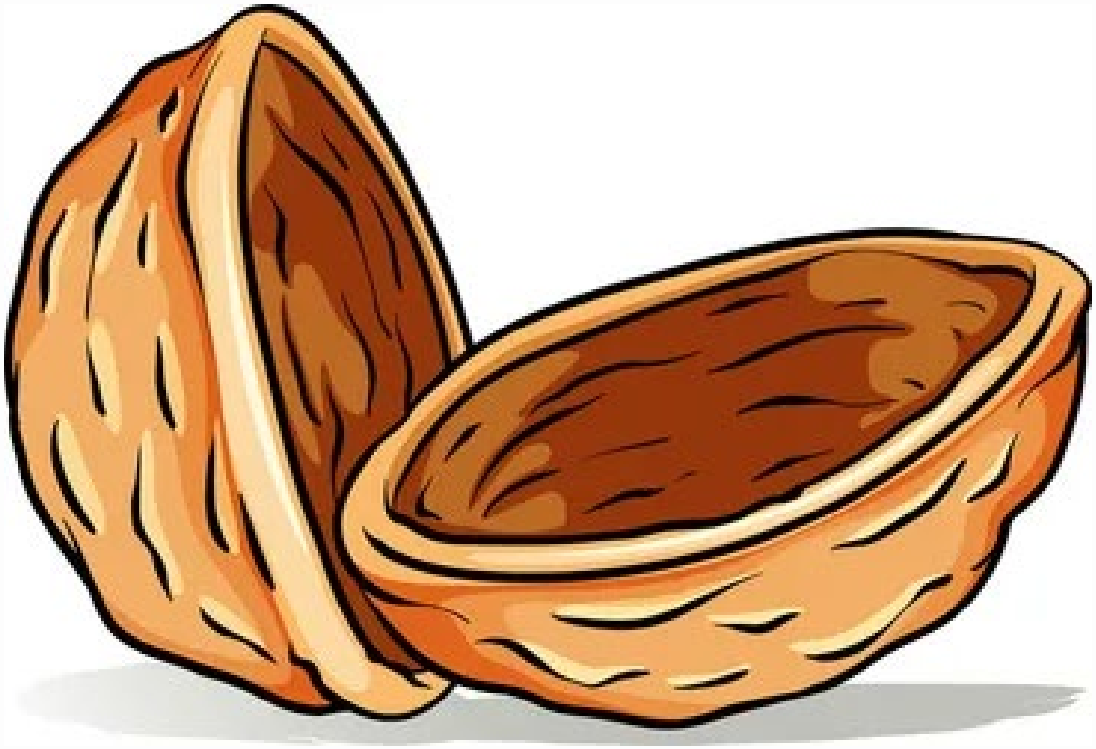
May 8, 2024

Nicole Alfafara
Oregon Health Authority
Drinking Water Services

Oregon Health Authority

PUBLIC HEALTH DIVISION
Drinking Water Service

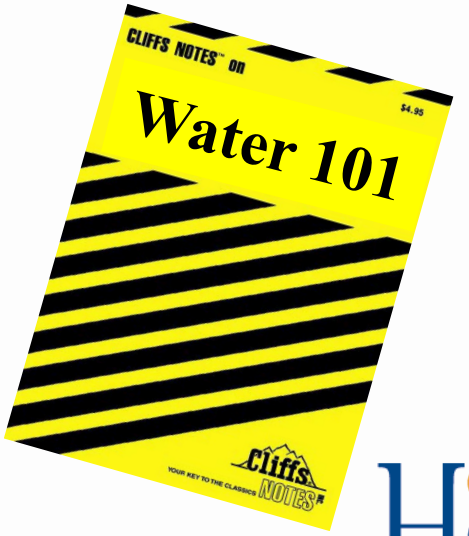
Operation and Maintenance Manuals: An Essential for Management & Compliance



Operation and Maintenance Manual

- O&M manual: a comprehensive, “how-to” document outlining procedures, protocols, and guidelines for operating, maintaining, and managing a water system.

- Purpose: Preserve and store system knowledge into established procedures and protocols to ensure the entire system is safely, consistently, and properly operated and well-maintained.



Essential for Water System Management

- O&M Manual → Customized application of Adair's renowned Action-Centered Leadership philosophy for the dynamics of water system management.

It outlines WHAT needs to be done, HOW to do it and WHEN…for water system operators (the WHO).

Essential for Water System Management

- An O&M Manual outlines WHAT needs to be done, HOW to do it, and WHEN…for water system operators (the WHO).

  - Detailed Protocols/Instructions for Routine Tasks = What / How / When.
    - ↑ Operational Efficiency & Productivity
    - ↓ Error or Accidents
    - ↑ Clarity / ↑ Communication of Expectations
    - ↑ Consistency / Standardization
    - ↑ System Understanding
      - ↑ Risk Management
      - ↑ Assets Management / Budget Planning Insight

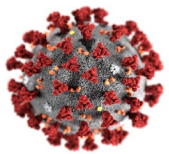
  - Reference Guide/Training Resource for Operators = Who.
    - ↑ Accountability
    - ↑ Continuity / ↓ Loss of System Knowledge

Essential for Water System Compliance

O&M Manual Requirements

OAR 333-061-0065(4)

- All public water systems must have a water system O&M manual.
- Must be evaluated every 5 years.
- Must include (but not limited to) procedures for:
  - Source operation and maintenance
  - Water treatment operation and maintenance
  - Reservoir operation and maintenance
  - Distribution system operation and maintenance
  - Written standard operating procedures for operators
- Staff must be trained in the use of O&M manual.

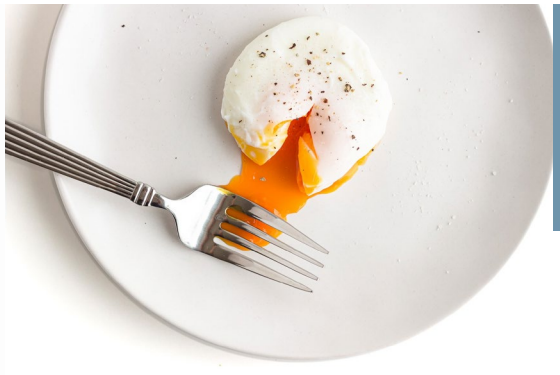



Mayhem is everywhere.


OUT OF STOCK
17
CI

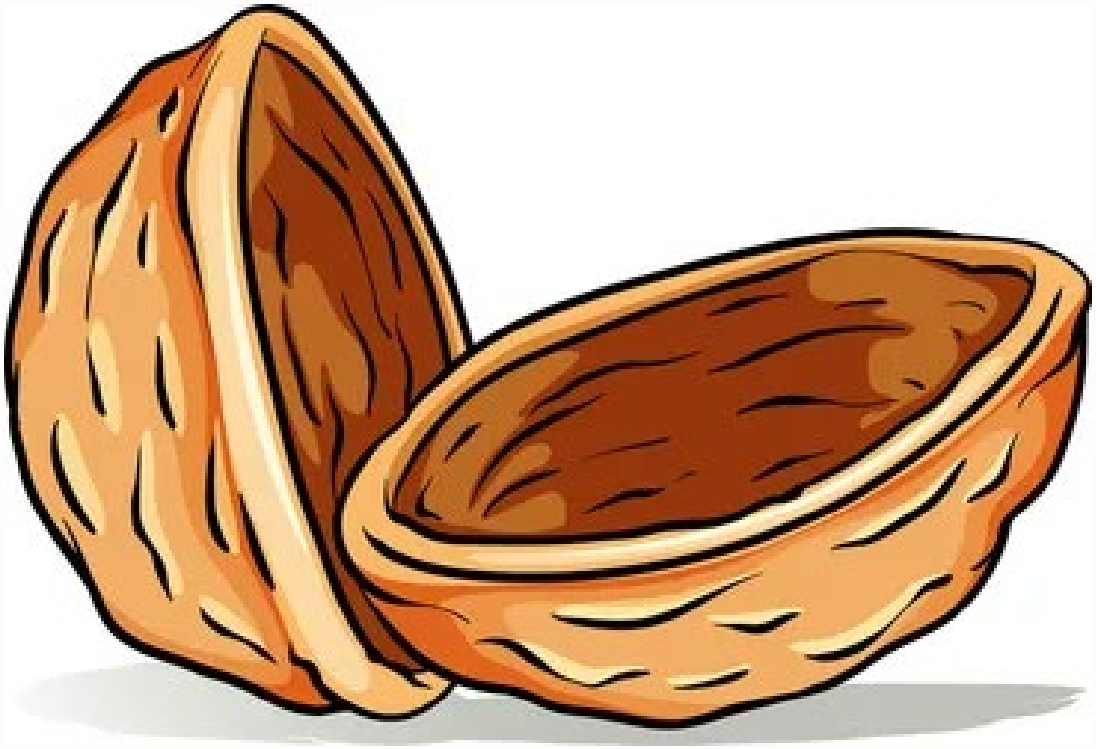
POWER OUTAGE

Mayhem is not limited to “emergencies”;
it can strike any day.



Operation and Maintenance Manuals: An Essential for Management & Compliance

..BUT also protection from mayhem.



O&M Manual Content

- System Contact Information List / Emergency Notification List
- Weekly Tasks: Weekly/Monthly/Quarterly/Rainy-Day
- Season Start Up / Shut Down Procedures
- Monitoring and Sampling Forms
- Laboratory Testing Information
- Record and Reporting Protocols
- Safety Protocols
- Best Management Practices
- Inventory List (equipment, vehicles, tools, chemicals, spare parts, supplies, etc.)
- Equipment Manufacturer's Manuals & Warranties
- Maintenance Information and Schedule
- Permits / Ordinances
- Fact Sheets

One Size Doesn't Fit All

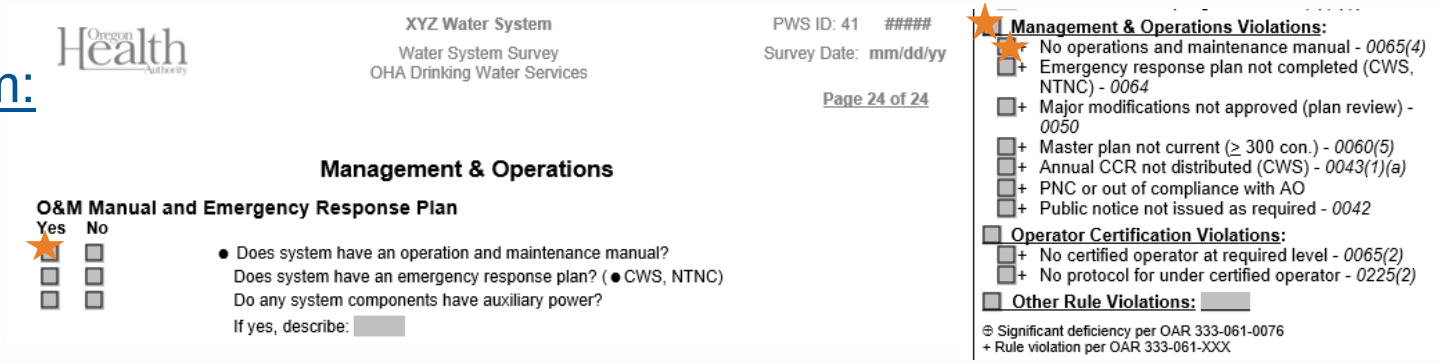
- Waster Systems Variability:.
  - Size
  - Source Water
  - Infrastructure (Treatment, DIST)
  - Requirements
  - Available Resources

- A standardized O&M manual can not adequately address the unique needs of each and every water system.

- A water system O&M manual should be customized and tailored to the specific water system.

Reviewing a O&M Manual

- Survey Item:



XYZ Water System
Water System Survey
OHA Drinking Water Services

PWS ID: 41 #####
Survey Date: mm/dd/yy

Page 24 of 24

Management & Operations

O&M Manual and Emergency Response Plan

Yes	No	
★		● Does system have an operation and maintenance manual?
		Does system have an emergency response plan? (● CWS, NTNC)
		Do any system components have auxiliary power?

If yes, describe:

Management & Operations Violations:
- ★ + No operations and maintenance manual - *0065(4)*
- + Emergency response plan not completed (CWS, NTNC) - *0064*
- + Major modifications not approved (plan review) - *0050*
- + Master plan not current (≥ 300 con.) - *0060(5)*
- + Annual CCR not distributed (CWS) - *0043(1)(a)*
- + PNC or out of compliance with AO
- + Public notice not issued as required - *0042*

Operator Certification Violations:
- + No certified operator at required level - *0065(2)*
- + No protocol for under certified operator - *0225(2)*

Other Rule Violations:

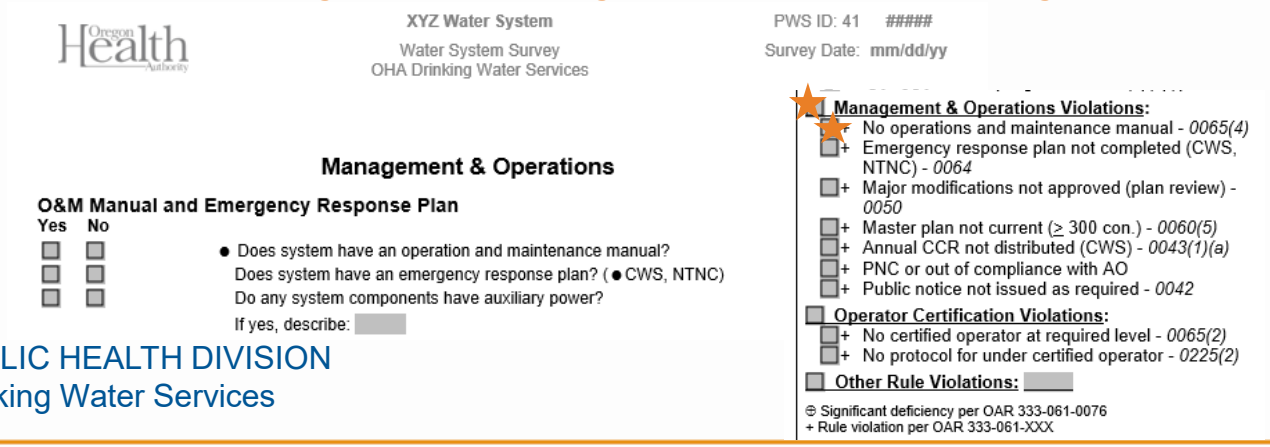
⊖ Significant deficiency per OAR 333-061-0076
+ Rule violation per OAR 333-061-XXX

- Things to Consider:
  - When was the last time this O&M manual was updated?
  - Are ALL system protocols and procedures documented?
    - Are there procedure or protocols for the new XXX that was constructed and is now in use?
    - Are there any procedures or protocols that are solely communicated verbally?
  - How are staff trained on the protocols and procedures outlined in this O&M manual?

Reviewing a O&M Manual

- More Things to Consider:
  - Is this O&M manual stored where it is easily accessible to system staff?
  - Is this O&M manual sufficient/adequate? Could it be improved?
  - Is this O&M manual relevant/usable? Could a random stranger pick this up and perform the tasks?
  - Assessing an O&M manual with a WSS significant deficiency lens demands a nuanced exercise of professional independent judgement.

Do you have any O&M Review tips you want to share?



XYZ Water System
Water System Survey
OHA Drinking Water Services

PWS ID: 41 #####
Survey Date: mm/dd/yy

Management & Operations

O&M Manual and Emergency Response Plan

Yes	No	
☐	☐	● Does system have an operation and maintenance manual?
☐	☐	Does system have an emergency response plan? (● CWS, NTNC)
☐	☐	Do any system components have auxiliary power?

If yes, describe:

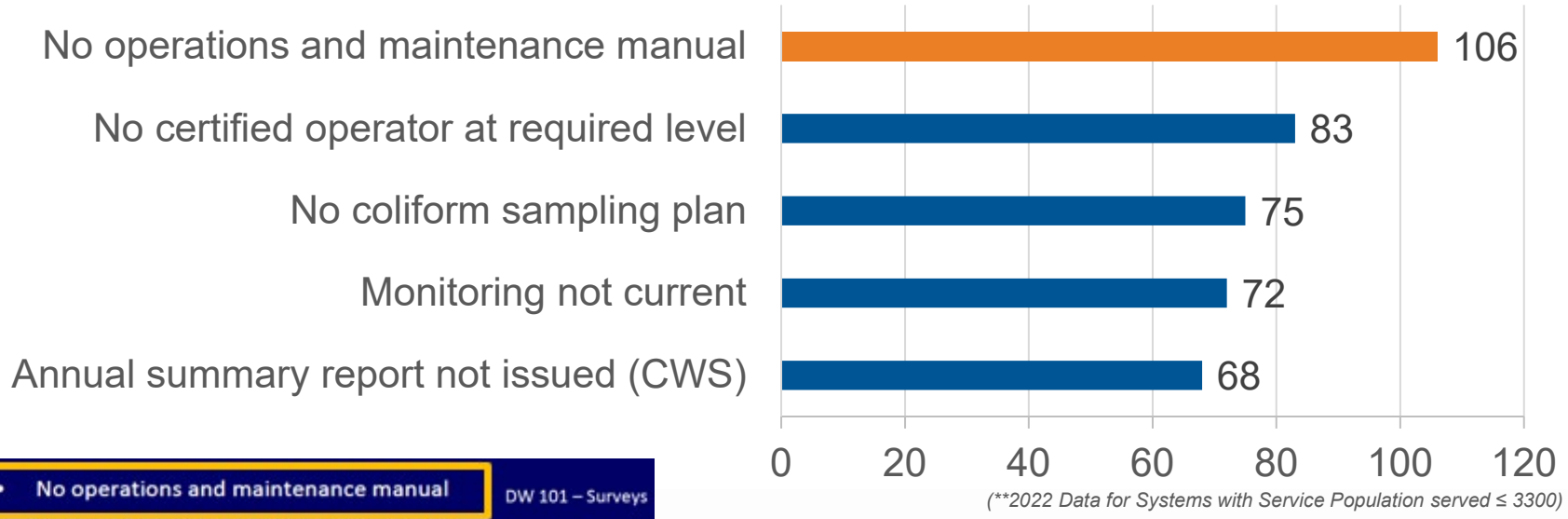
Management & Operations Violations:
- + No operations and maintenance manual - *0065(4)*
- + Emergency response plan not completed (CWS, NTNC) - *0064*
- + Major modifications not approved (plan review) - *0050*
- + Master plan not current (≥ 300 con.) - *0060(5)*
- + Annual CCR not distributed (CWS) - *0043(1)(a)*
- + PNC or out of compliance with AO
- + Public notice not issued as required - *0042*

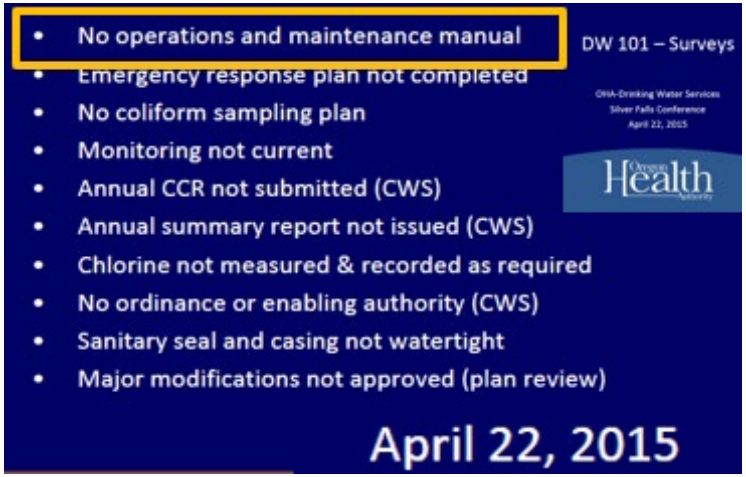
Operator Certification Violations:
- + No certified operator at required level - *0065(2)*
- + No protocol for under certified operator - *0225(2)*

Other Rule Violations:

⊖ Significant deficiency per OAR 333-061-0076
+ Rule violation per OAR 333-061-XXX

Frequently Observed & Commonly Unresolved Significant Deficiency





There are currently 182 public water systems with the “No O&M Manual” Significant Deficiency left unresolved.

POLL

Why do you think systems struggle with developing and maintaining a O&M manual?

A. Lack Experience/Knowledge: Do not know what is needed or unaware it is a regulatory requirement.
B. Overwhelmed by Complex Task: Do not know where to start.
C. Resource Limited: Time constrained and/or juggling multiple tasks/projects = not prioritized.
D. Perceived Unimportance = Undervalue O&Ms: Believe they are useless or think they can manage without one. “Blah blah on a bunch of paper”, “It is all in my head, I know what to do.”
E. Viewed O&M manuals as Not Necessary: “My system is small/not complex”, “We are a school not a water utility”.
F. Other: ?

Put Yourself In Their Shoes

Protect a Drinking Water System from Mayhem w/ O&M Manual Tips & Resources

Motivational Strategies & Time Management Tips

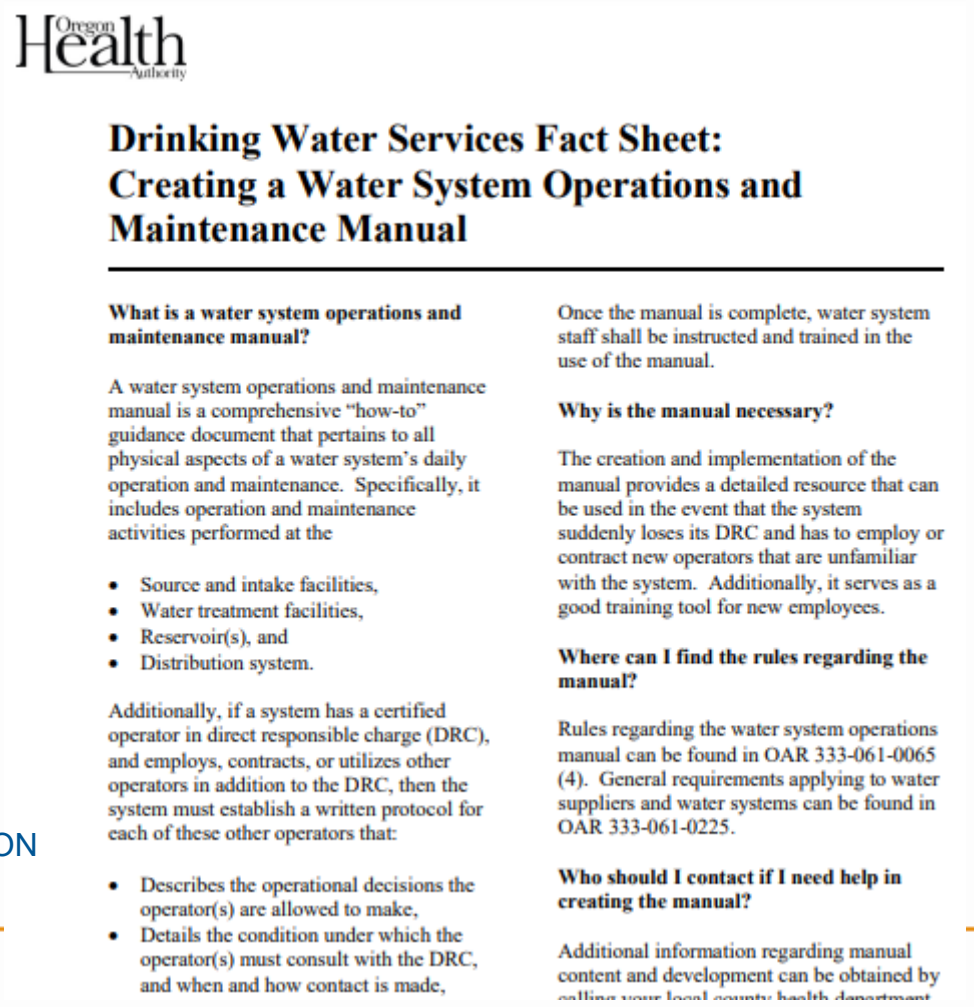
- Highlight O&M Manual Significance
- Clarify Rule Requirements and Expectations
- Provide Resources
- Suggest Breaking Manual Development Down into Smaller Steps
- Recognize and Acknowledge Progress

Do you have any tips you want to share?

Resources

Resource: Guidance Document

- OHA O&M Fact Sheet



Oregon Health Authority

Drinking Water Services Fact Sheet: Creating a Water System Operations and Maintenance Manual

What is a water system operations and maintenance manual?

A water system operations and maintenance manual is a comprehensive "how-to" guidance document that pertains to all physical aspects of a water system's daily operation and maintenance. Specifically, it includes operation and maintenance activities performed at the

- Source and intake facilities,
- Water treatment facilities,
- Reservoir(s), and
- Distribution system.

Additionally, if a system has a certified operator in direct responsible charge (DRC), and employs, contracts, or utilizes other operators in addition to the DRC, then the system must establish a written protocol for each of these other operators that:

- Describes the operational decisions the operator(s) are allowed to make,
- Details the condition under which the operator(s) must consult with the DRC, and when and how contact is made,

Once the manual is complete, water system staff shall be instructed and trained in the use of the manual.

Why is the manual necessary?

The creation and implementation of the manual provides a detailed resource that can be used in the event that the system suddenly loses its DRC and has to employ or contract new operators that are unfamiliar with the system. Additionally, it serves as a good training tool for new employees.

Where can I find the rules regarding the manual?

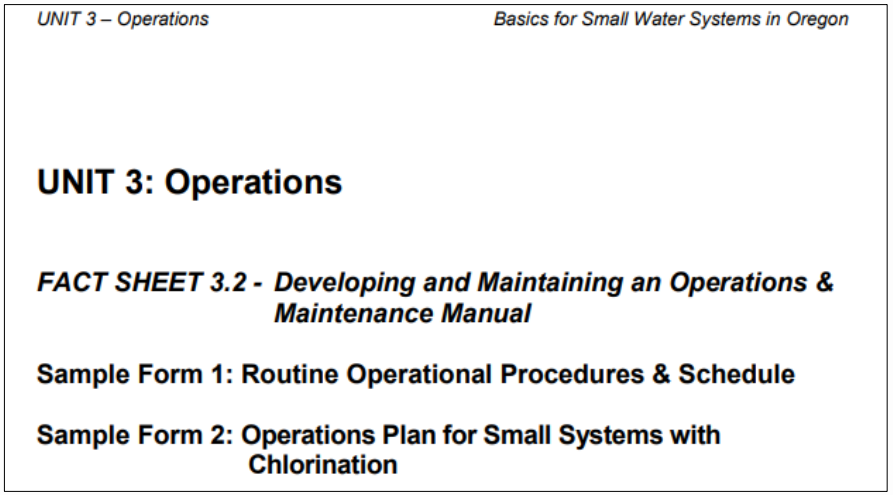
Rules regarding the water system operations manual can be found in OAR 333-061-0065 (4). General requirements applying to water suppliers and water systems can be found in OAR 333-061-0225.

Who should I contact if I need help in creating the manual?

Additional information regarding manual content and development can be obtained by

Resource:
Guidance Doc, Examples, & Templates

- Basics for Small Water Systems in Oregon Manual (2009) -Unit 3: Operations, Fact Sheet 3.2



Unit 3: Operations, Fact Sheet 3.2 - ONLY

Resource:
Guidance Doc, Examples, & Templates

- Basics for Small Water Systems in Oregon Manual (2009)
  Unit 3: Operations, Fact Sheet 3.2 - ONLY

Operations & Maintenance Plan - Example Outline

I. SYSTEM FACILITIES

- Description of water system facilities
- Distribution system map showing location of piping, valves, fire hydrants, blow-off hydrants, system-owned backflow assemblies, etc.

II. SYSTEM OPERATION & MAINTENANCE

- Operational and maintenance procedures including:
  - Maintaining distribution system pressure
  - Responding to loss of pressure
  - Main disinfection program
  - Flushing water lines, hydrant inspection and testing (how often, etc.);
  - Inspection and exercising of water main valves;
  - Master flow meter maintenance;
  - Storage tank inspection and cleaning;
  - Cross connection program (installation, testing, etc.);
  - General maintenance plans.
- Maintenance Schedule
- Record keeping procedures

III. SAMPLING & REPORTING REQUIREMENTS

- Overview of sampling requirements
  - Sample collection procedures
    - Coliform Sampling Plan
    - Lead and copper sampling
    - Disinfectant By-Products sampling
  - Sampling schedule (daily, weekly, monthly, annually, etc.)
  - Lab contact information
- Overview of reporting requirements
  - Public notification and education
  - Consumer Confidence Report (CCR) preparation

IV. EMERGENCY PROCEDURES

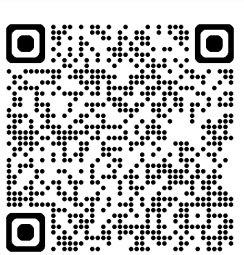
- Emergency operational practices (e.g., interruption of water services, contamination events);
- Emergency contact list (e.g., regulatory contacts, lab services, pump repair, leak detection, mutual aid systems)
- AND/OR Emergency Response Plan

V. OWNER / OPERATOR

- List of operational personnel (including employee name, job title, certification, operator certification number and grade level)
- Responsibilities and routine tasks of operational personnel
- Daily operational practices and operational objectives
- Consumer complaint response procedures

Resource:
Guidance Doc, Examples, & Templates

- Basics for Small Water Systems in Oregon Manual (2009)
  Unit 3: Operations, Fact Sheet 3.2 - ONLY



Sample Form 1:
Routine Operational Procedures & Schedule

System Name: _____

List tasks that are performed and the frequency and who is responsible for performing that task. A separate page should be used to describe the procedure in detail for each task, if needed.

Daily Task	**Performed by**
1. Inspect well	_____
2. Check Storage Tank	_____
3. Maintain gauges & valves	_____
4. Maintain distribution system	_____
5. Respond to consumer complaints	_____
Weekly Task	**Performed by**
1. Inspect valves	_____
Monthly	**Performed by**
1. Take Bacteriological sample	_____
Semi-Annually	**Performed by**
1. Flush dead end lines	_____
2. Flush sediment from storage tank	_____
3. Exercise valves	_____

Resource:
Guidance Doc, Examples, & Templates

- Basics for Small Water Systems in Oregon Manual (2009)
  Unit 3: Operations, Fact Sheet 3.2 - ONLY

Sample Form 2:
Operations Plan for Small Systems with Chlorination

For small water systems with a well, storage tank, chlorinator and distribution system, operated by owner or manager.

SYSTEM FACILITIES

- **System Description**: Provide a brief description of source, storage, chlorinator unit (treatment) and number of connections.

  Example: 200 foot well drilled in 1972, 1500-gallon welded steel storage tank, chlorinator with a diaphragm type pump (manufacturer and model) and 25-gallon disinfectant reservoir, serving 15 connections.

- **Map of Distribution System**: List applicable maps, description of information included, and where the maps are kept.

SYSTEM OPERATION & MAINTENANCE

- **Routine Operational Procedures:** Describe operational procedures for each component of the system. Example information to include is shown below.

  A. Visual inspection of **WELL** (daily).
  1. Check for the following: leaks, openings, lubricants, electrical hazards, chemical hazards, etc. (record observations and correct problem).
  2. Check the pump for proper operation.

  B. Visual inspection of the **STORAGE TANKS** (daily).
  1. Inspect for any leaks or damage (record observations and repair as needed).
  2. Record system pressure. Record the pressure when the pump turns on, the pressure when the pump turns off and the duration of the run time.

  C. Visual inspection of **CHLORINATOR PUMP** and disinfection reservoir (daily).
  1. Inspect the pump for proper operation. Inspect the disinfectant in the reservoir for concentration and adequate volume for the operational period (record results).
  2. Determine if there is enough disinfectant on hand for one or more weeks.

  D. Measure the **DISINFECTANT RESIDUAL** in the distribution system (free chlorine test kit required).
  1. Record the results (at least twice a week, on attached sheet).
  2. Determine if an adequate level of disinfectant is maintained.
     a. If disinfectant level is low, determine the reason and correct.
     b. If no measurable disinfectant, notify owner, determine reason, and remedy. If no disinfectant for 24 hours, notify the regulating agency.

  E. Maintenance of **GAUGES** and **METERS**.
  1. Inspect all gauges and meters for leaks and proper function daily. Repair or replace as needed (keep record of date).

  F. Inspection and **EXERCISING** of the **VALVES**.
  1. Inspect valves for leaks (record observations, repair or replace if leaking).
  2. Exercise valves on a schedule, as needed (e.g., quarterly, semi-annually, annually, record dates on attached sheet).

  G. Operation and maintenance of **DISTRIBUTION FACILITIES**.
  1. Visually inspect the distribution system for leaks on a regular basis. Record date and observations.
  2. Flush dead end mains or lines periodically (quarterly, semi-annually, annually as needed. Record date and observations).
  3. Cleaning of storage tank (quarterly, semi-annually or annually). Record date cleaned and observations.

- **Maintenance Schedule**: List tasks that are performed and the frequency and who is responsible for performing that task (See Sample Form 1).

MONITORING & REPORTING

- **Sampling Requirements**:

  A. **BACTERIOLOGICAL SAMPLING**: As per approved Coliform Sampling Plan, report coliform results to DWS by the 10th of the month following the sample.
  1. If sample is positive, notify DWS immediately and take required repeat and source samples.
  2. If your system is currently on [illegible] need to collect additional col[illegible] a positive result (just your routine monthly samples). However, if your system is on a quarterly coliform schedule (which applies to some non-community systems), then a total of three routine coliform samples should be collected the month following a positive result.
  3. Keep bacteriological results for five years.

  B. **CHEMICAL SAMPLING**: forward required results to DWS.
  1. Keep chemical results for ten years.
  2. Keep variance and exemptions for five years.

- **Reporting Requirements**.

  A. **PUBLIC NOTIFICATION** of violation required.
  1. Notification shall be given based on the "tier" of violation, or in a manner directed by the OHA-DWS.
  2. State problem and what has been done to correct it.
  3. Send a copy of the notification to the OHA-DWS.

  B. **CONSUMER CONFIDENCE REPORT** required annually.
  1. Develop CCR annually.
  2. CCR distributed to customers by July 1st of every year.
  3. Complete certificate that specifies when and how the CCR was distributed. Submit the certificate to the OHA-DWS no later than October 1st.

EMERGENCY OPERATIONAL PROCEDURES: May refer to the Emergency Response Plan. Also, include the additional information described below.

A. List of **equipment on hand** for emergency repairs.
1. Miscellaneous wrenches.
2. Leak clamps.

B. List of sources of needed equipment, not on hand. Name and address of supplier and type of equipment.

Name	Address	Phone#	Equipment	Rental/ Contract
			Steel Tank Welder	
			Electrical Repair	
			Digging Equipment	
			Generator	
			Chemicals	

Resource: Template

- Marion County O&M Template: https://www.co.marion.or.us/HLT/PH/EHS/water

Operations and Maintenance Manual for

Water System _____

PWS 41-_____

Owner_____Phone_____

Operator_____ Phone_____

Direct Responsible Charge_____

Training/certification_____

System Address_____

Source information (attach well log if available)

Known as_____
Location_____
Casing_____
Depth_____
Pump_____
Pump setting_____

Contact for repair or replacement at well head

_____

_____

_____

Location_____

Size_____

Inspection dates_____

Cleaning schedule_____

Contact for repair or replacement of storage reservoir

_____

_____

_____

Emergency Response Plan (ERP) attached at
Completed_____
Updated_____

Marion County Contact: Greg DeBlase, 503-

- This manual meets the requirements fou
- Operator requirements are listed in OAI
- This is a living document and will be ug
- This document will be reviewed during

Startup sequences
Location_____
HOW_____

Shut-down sequences
HOW_____

Problems with startup or shut-down

Operator	Dated	Problem	Correction	Service

(If depressurized for off-season, complete a state-approved start-up procedure)

Seasonal system startup procedures website: bit.ly/seasonalstartup

Operations and Maintenance Manual - 4 -

Complete loss of pressure:

- ☐ Boil water notice posted to users (link below)
- ☐ Contact state drinking water program
- ☐ Make corrective actions to restore service
- ☐ Flush
- ☐ Restore service, verify service pressure and chlorine residuals
- ☐ Collect coliform samples to demonstrate water safety, obtain coliform-absent results before proceeding
- ☐ Notify users that water is safe to use after they flush their household plumbing

Operator	Dated	Problem	Correction	Service

Public Notices link

http://public.health.oregon.gov/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/Pages/publicnotices.aspx

Operations and Maintenance Manual - 5 -

Routine Daily Operations

_____

Routine Monthly Operations

_____

Routine Semi-Annual Operations

_____

Routine Annual Operations

_____

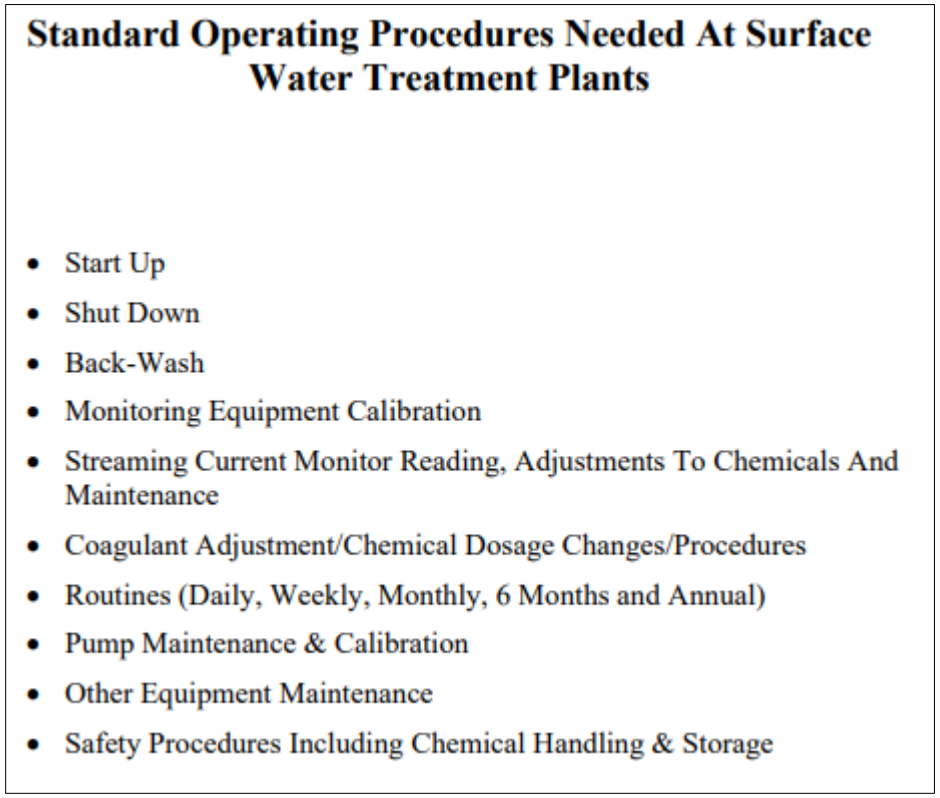
System winterization

_____

Operations and Maintenance Manual - 6 -

Resource: Guidance Document

- SOPs Needed at Surface Water Treatment Plants



Standard Operating Procedures Needed At Surface Water Treatment Plants

- Start Up
- Shut Down
- Back-Wash
- Monitoring Equipment Calibration
- Streaming Current Monitor Reading, Adjustments To Chemicals And Maintenance
- Coagulant Adjustment/Chemical Dosage Changes/Procedures
- Routines (Daily, Weekly, Monthly, 6 Months and Annual)
- Pump Maintenance & Calibration
- Other Equipment Maintenance
- Safety Procedures Including Chemical Handling & Storage

Resource: Template

- EPA Drinking Water System Weekly Inspection Checklist

[System Name] Drinking Water System
WEEKLY Operation & Maintenance (O&M) Inspection Checklist

Operator Name: _____ **Date:** _____ **Well Pump House Name:** **[Well # and Name]**

Note: All maintenance activities resulting from this checklist should be documented in a logbook and include the date and the name of the person performing the activity and a description of what was completed. All items requiring maintenance or updates should be completed within 30 days.

Weekly O&M Item – Well Pump House Exterior	Yes	No	Required Maintenance Or Updates Needed	Completion Date
Entry gate locked				
Security fencing around wells and well house intact				
No security concerns (e.g., vandalism, unauthorized access)				
Well caps secured				
Grading sloped away from the well casing				
Dry around well casing (i.e., no standing water)				
Well casings in good condition (e.g., no cracks)				
Controlled vegetation (e.g., no uncut grass, brush, or dead trees)				
Other[1]:				
Other[1]:				
Other[1]:				

Weekly O&M Item – Well Pump House Interior	Yes	No	Required Maintenance Or Updates Needed	Completion Date
Piping system sealed (e.g., no signs of leaks, no water on the floor)				
Piping in adequate condition and properly supported				
Pressure gauges in good condition (e.g., not damaged or unreadable)				
Pressure relief valves closed and screened				
Pressure tank in good condition (e.g., no evidence of leaks, not water-logged)				
Flow control valves from pressure tank in proper position				

Oregon Health Authority

Resource: Template

- EPA Drinking Water System Weekly Inspection Checklist

Weekly O&M Item – Well Pump House Interior	Yes	No	Required Maintenance Or Updates Needed	Completion Date
Flow meter read and recorded				
Water pressure in normal range (Insert Range-XX to XX psi)				
Pumps cycling appropriately (e.g., pumps do not run continuously, pumps cycle no more than 6 times per hour)				
Lighting system fully functional				
Electrical power to well pumps on and panel in good condition				
Sample collection taps closed and labeled				
Other[1]:				
Other[1]:				
Other[1]:				

1. Describe all other conditions being evaluated.

Additional Notes:

Resource: O&M Manual Training Course

- OAWU routinely offers a course on O&M Manual Development.

Resource: O&M Manual Training Course

- OAWU routinely offers a course on O&M Manual Development.

Month Day	Vehicle Pre-Trip	Storage Tank Inspection	Inspection well(s)	Work Orders Review	Chlorine Residual	Fire Hydrant Inspection	Tour Dist System (Leaks)	Telemetry System	Line Locates	Consumer Complaints	Other	Other
1												
2												
3												
4												
5												
6												
7												
8												

WEEKLY	
Task	Des
Inspect	Chlorine testing equipmen
Other	
Other	
Safety	Conduct safety meetings a
Pump House	Clean, inspect..... mow law
Office	Restroom, kitchen cleaned

EMERGENCY MANAGEMENT NOTIFICATION LIST

Title	Name	Telephone
WATER SYSTEM PERSONNEL		
Lead Operator of Record:		
City Administrator / Manager:		
Board President:		
Other Personnel:		
EMERGENCY PERSONNEL		
Fire Department: Station #		
Sheriff Department:		
Hazardous Materials Response:		

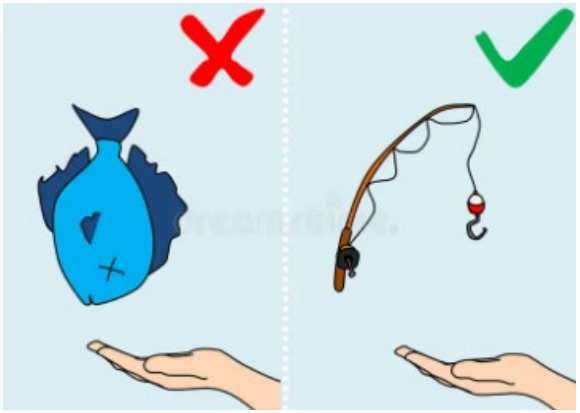
QUIZ

What is the most valuable resource for managing a water system effectively, ensuring smooth operations, and attaining regulatory compliance?

A. O&M Manual
B. Corrective Action Plan for lack of a O&M
C. Operational Resources (guidance documents, templates, examples, etc.)
D. Training Courses / Programs
E. Operator Peer Network (Collaboration/Communication w/ Nearby Systems)
F. Technology / Software (SCADA, asset management software, predictive analytic tools)
G. Google
H. Professional Affiliations (AWWA, OAWU, etc.)
I. Consultants and Engineering Firms
J. Other: ___?___

Hint

Ok…BUT



Your Guidance and Support Matters

Like a good drinking water contact,
be there (to guide) …
and suggest systems get O&M flare.

Together and with a O&M manual we
can make mayhem more rare.

Operation and Maintenance Manuals: An Essential for Management & Compliance

in Theory

BUT

A Roadmap for Providing Safe Drinking Water & Safeguarding Public Health in Practice

Questions & Contact Information

My Contact Information:

- Phone: 503-278-1531
- Nicole.H.Alfafara@oha.oregon.gov

General DWS Program Contact Information

- Email: info.drinkingwater@odhsoha.oregon.gov
- Phone: 971-673-0405
- Fax: 971-673-0694

O&M Manuals:
An Essential for Management & Compliance

Drinking Water Partners Spring Training

May 8, 2024

Nicole Alfafara
Oregon Health Authority
Drinking Water Services

Oregon Health Authority

PUBLIC HEALTH DIVISION
Drinking Water Service