Basics

For Small Water Systems in Oregon

UNIT 1: Essential Information and Considerations

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Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 1.1 - Drinking Water and Public Health Protection

1.1.1 - Background on Drinking Water Standards

The Safe Drinking Water Act (SDWA) is the primary federal legislation established to protect public health through regulation of the nation's public drinking water supply. Congress signed it into law on December 16, 1974. There were amendments made to SDWA in 1986 and 1996. The SDWA applies to each of the more than 170,000 public water systems in the United States.

The SDWA gave the federal government, through the Environmental Protection Agency (EPA), authority to:

- Set minimum national standards for the levels of contaminants in drinking water.
- Require all public water systems to monitor for contaminants and report any identified contaminants.
- Provide protection for water sources such as rivers, lakes, reservoirs, springs and groundwater.
- Establish guidelines for the acceptable treatment technologies for reduction of contaminants from water.

The SDWA establishes primary and secondary drinking water standards for microbial and chemical contaminants that may be found in drinking water.

Primary drinking water standards are regulations that address waterborne contaminants that may cause illness or death and are set by EPA to minimize health risks posed by these contaminants. Primary standards set enforceable maximum contaminant levels (MCLs), or for some contaminants an action level.

- An **MCL** is the highest level at which a contaminant can occur (but cannot exceed) for the water to be considered safe to drink. Available technology, the cost of treatment, and sound science are all considered in setting these standards.
- An **Action Level** is set for some contaminants instead of an MCL. If the action level is exceeded, the water supplier is required to take additional steps. Depending on the contaminant, exceeding an Action Level may require customer notification, additional testing and/or eventually require installation of equipment to reduce the contaminant.

The EPA also sets **secondary standards** for contaminants that affect the aesthetics of water but are not a public health threat. Secondary standards are not enforceable. Contaminants with these standards are usually minerals or gasses that cause water to taste or smell bad, or be discolored. For example, a water source that has high iron content will produce water that may be red in color or have particles of red floating in it. Although this makes the water less desirable to the consumer, it is not necessarily a health threat.

SDWA also gives state regulatory agencies the power to act as a **primacy agency** for enforcing the act’s regulations. In the state of Oregon, enforcement of SDWA is the responsibility of the Oregon Health Authority, Drinking Water Services.

Originally, SDWA focused primarily on treatment of drinking water as the best way to get safe drinking water to the tap. However, the 1996 amendments went further than simply treating water. The amendments addressed source water protection, operator training, funding for water system improvements and consumers’ “right-to-know” through public information.

The regulatory system is designed to provide a **Multiple Barrier Approach** to protection. This includes source water protection, water treatment when required, distribution system integrity and public information. If one of these barriers is breached, the risk can be resolved at another barrier point to protect public health and safety.

1.1.2 – Acute vs. Chronic Health Effects

Drinking water contaminants can cause illness that we can classify based on how long it takes for symptoms to appear after exposure.

Acute effects typically occur within hours to weeks of exposure. Problems may result from consumption of very small amounts of contaminated water—even a single exposure.

Acute effects most often result from microbial infections, but some chemicals (e.g., nitrate) can cause acute effects if present in high enough concentrations.

Chronic health effects such as cancer or organ damage generally result from prolonged exposure to low concentrations of drinking water contaminants, with the onset of disease occurring months to years after exposure. Chronic health effects are usually associated with chemical contaminants.

1.1.3 - Types of Contaminants: Microbial vs. Chemical

There are two primary types of contaminants, microbial and chemical.

Microbial contaminants include bacteria, viruses, and protozoa:

- **Bacteria** are single celled microorganisms of many different shapes and species that possess no well defined nucleus.
- **Viruses** are extremely complex molecules that have no independent metabolism and depend on living cells for reproduction. They do not live long outside of the human body, but while alive can withstand heat, drying and chemical agents.
- **Protozoa** are one-celled organisms within a cyst that can be difficult to treat. The most common protozoa are *Giardia lamblia* and *Cryptosporidium*.

These organisms can enter a water system quite easily if proper treatment methods are not in place. Microbial contaminants that cause acute illness in humans are sometimes referred to as **pathogens** and nearly always originate in animal or human feces.

Microbial contaminants find their way into water systems at either the source, in storage or through the distribution system in a variety of ways:

- Groundwater wells may be contaminated by runoff, infiltration from animal wastes, septic tanks or poorly operated wastewater treatment facilities. Although shallow wells are most susceptible, even deep wells may be affected if they are not cased properly, or if the casing has deteriorated.
- Improperly screened vents and overflows or other openings on storage tanks may be an avenue by which microbial contaminants may enter a water system.
- Cross connections within the distribution system are another frequent source of contamination. These are connections between a public water system and a source of non-potable liquid, or gas including underground sprinkler systems, unapproved individual wells or other

sources of water (springs, creeks, lakes and ponds).

Chemical contaminants of concern may occur naturally in water, as a result of human activity or may be created in the water treatment process. Chemicals have been separated into four classes for regulatory purposes:

- **Inorganic chemicals (IOCs)** come from natural occurring mineral materials such as salts, iron and calcium as well as from industrial contamination. These chemicals may be present on rocks and in soil and can be carried into groundwater supplies by surface water that percolates into the ground.
- **Synthetic organic chemicals (SOCs)** are manmade, carbon-based compounds that are typically found in pesticides, herbicides and fungicides. Others are used in the making of plastics. Nearly all SOCs commonly found in water are from pesticides with a few notable exceptions (PCBs and dioxin).
- **Volatile organic chemicals (VOCs)** are man-made compounds that readily vaporize from water into the air at normal temperatures. They are commonly used as solvents, fuels, paints, or degreasers. They present a health risk not only from drinking contaminated water, but also from inhaling VOCs that escape from the water as it is used during showering or other home uses. VOCs also may be absorbed directly through the skin during bathing and showering. VOCs may cause cancer or damage to the liver, kidneys, nervous system, or circulatory system.
- **Radionuclides** can occur as a result of human activities or natural sources. Natural radionuclides are radium 226, radium 228 and radon. These are most common types found in groundwater sources. Man-made radionuclides can find their way to water systems as a result of scientific and industrial users of radioactive materials, wastewater discharge from nuclear power plants, discharges from the mining of radioactive materials and improper handling or storage of waste radioactive materials. Radon gas is most often present in granite formations.

1.1.4 - Waterborne Disease and Health Effects of Water Pollution

Waterborne disease and other health effects can be caused when microbial, or chemical contaminants enter the drinking water supply.

Pathogenic agents can cause a variety of illnesses in humans. The spectrum of waterborne illness is very broad, ranging from asymptomatic or very mild infection to life-threatening disease. Gastrointestinal symptoms (e.g., diarrhea and vomiting) are common manifestations for many of these pathogens. Some of the pathogens of particular importance in Oregon are listed in **TABLE 1.1.4**.

Laboratory methods exist to differentiate the various types of bacteria, but they are more difficult, time consuming, and expensive than the total coli-form tests. Similarly, special water sampling procedures and equipment are required to sample for viruses and protozoa. As a result, these tests are not routinely conducted.

The most common test used to determine if bacterial pathogens are present in drinking water is a relatively easy and inexpensive test called the **total coliform test**.

Coliform bacteria are a classification of bacteria that are naturally occurring in the air, soil, and water as well as in the intestinal track of warm blooded animals. The water industry uses this test as an indicator of possible fecal contamination or the presence of other pathogens in the water system.

If present, a contaminant pathway may exist between a contamination source and the water supply. Because coliform bacteria stay in water longer than most disease causing organisms, the absence of coliform bacteria leads to the assumption that the water supply is microbiologically safe to drink.

Elevated levels of coliform bacteria suggest problems in the system. Sources of the problem may include runoff, infiltration, leaching, cross-connections, inadequate disinfection, and others. A positive test for coliform does not necessarily imply the presence of pathogens, but it suggests a potential for contamination of the water that demands immediate attention. For more information on health effects of other microbial and chemical contaminants see

EPA's website list of Contaminants and MCLs:

http://www.cdc.gov/healthywater/diseases.html

http://water.epa.gov/drink/contaminants/#List

Or contact your local health department or the Drinking Water Services.

TABLE 1.1.4 - Common Microbial Contaminants and Potential Health Effects

Microbial contaminant	***Type of microorganism***	***Sources of contaminant***	***Potential health effects from ingestion through water***
Norovirus (Norwalk-like viruses)	Virus	Human feces Shellfish grown in polluted waters	Causes acute gastroenteritis. Is highly contagious. Symptoms include vomiting and diarrhea. Symptoms last one or more days.
Escherichia coli O157:H7 (or, E. Coli O157:H7)	Bacterium	Animal or human feces	Symptoms include diarrhea and occasionally kidney failure. Symptoms last five to ten days.
Shigella	Bacterium	Human feces	Symptoms include diarrhea, fever and stomach cramps
Giardia Lamblia	Protozoan	Animal or human feces	Symptoms include cramps, nausea, and general weakness. Symptoms may last two to six weeks, or longer.
Cryptosporidium	Protozoan	Animal or human feces	Symptoms include diarrhea, stomach pain, vomiting. Symptoms typically last one to two weeks.

Source: Center for Disease Control, Disease information web-site http://www.cdc.gov/healthywater/diseases.html

1.1.5 - Waterborne Disease Outbreaks in Oregon

Prevention of waterborne infections requires good separation of human and animal waste from drinking and recreational water sources. In Oregon and other parts of the developed world, sanitation and drinking water systems are generally well developed and adequately maintained, and waterborne disease is relatively uncommon. In developing countries, where sanitation may be poor or almost non-existent and safe drinking water is the exception rather than the rule, morbidity and mortality from these infections is common.

While drinking water is generally safe in Oregon, we cannot afford to be complacent. Safe water is only available because operators work hard and resources are invested to keep it so. Deferred maintenance, "accidents," unusual rainfall events, mechanical failures - any number of things - can stress and sometimes overload even the best systems. When that happens, the potential for waterborne disease can go up very quickly.

Outbreaks of disease traced to drinking water have become fairly uncommon in the United States. Most outbreaks identified over the past 20 years, with a few notable exceptions, have been very small, and typically involve poorly maintained systems in rural areas.

Awareness of potential sources of contamination for your own system is important in preventing an outbreak or contamination event. A list of reported disease outbreaks in Oregon with identified causes is included in **TABLE 1.1.5**.

TABLE 1.1.5 - Reported Disease Outbreaks- Oregon Public Water Systems

Year	Location	Organism	No. of Cases	Water Source	Cause
1975	Crater Lake National Park	Enterotoxigenic *E. coli*	1,000	Spring	Inadequate chlorination; sewage contam.
1978	Century Drives Apts. (Linn Co.)	*Shigella*	34	Well	Source contamination
1979	Colton	unknown	300	Surface water	Inadequate chlorination; no filtration
1979	Government Camp	*Giardia*	120	Surface water	Inadequate chlorination; no filtration
1979	Zig Zag (Lady Creek) Cabins	*Giardia*	66	Surface water	Interrupted chlorination; no filtration
1980	Rockaway Beach	*Giardia*	63	Surface water	Inadequate chlorination; no filtration
1982	Corbett	*Giardia*	19	Surface water	Inadequate chlorination; no filtration
1984	Canyonville	*Giardia*	42	Surface water	Inadequate filtration
1984	Pacific City	*Campylobacter*	22	Surface water & wells	Inadequate chlorination; no filtration

Year	**Location**	**Organism**	**No. of Cases**	**Water Source**	**Cause**
1984	Willamina (Mill)	unknown	20	Surface water	Cross connection with fire system
1992	Jackson County (two outbreaks)	*Cryptosporidium*	3,000	Surface water; possibly spring	Inadequate filtration; possible infiltration of spring water
1994	Florence (school)	unknown	10		Water cooler contamination (common spout)
1997	Grants Pass (campground)	*Giardia*	100	Well & spring	Rodent contam. of distribution storage tank
2005	Yamhill County (camp)	unk – pos tests for E*.coli 0157, shigella & campylobacter*	60	Surface water	Inadequate chlorination & filtration
2006	Salem	*Norovirus G1*	48	Well	Untreated groundwater
2013	Baker City	*Cryptosporidium*	2,000	Surface Water	Inadequate treatment

Source: Oregon Waterborne Disease Outbreaks (1971-2013) CDC Database and OHA records.

UNIT 1: Essential Information and Considerations

FACT SHEET 1.2 - Basic Responsibilities of Water Suppliers

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 1.2 - Basic Responsibilities of Water Suppliers

1.2.1 - Oregon Revised Statutes and Duties of OHA

Oregon Health Authority (OHA) serves as the state's primacy agency for enforcing regulations under the Safe Drinking Water Act.

As the regulating agency, OHA, has duties and responsibilities to protect public health and safety as outlined by the state legislature in ORS 448.150. These requirements include the authority to develop and adopt administrative rules which have the force of law. The rules are set forth in the Oregon Administrative Rules (OARs) Chapter 333-061. A copy is available on the Drinking Water Service's website or from your local health department.

By statute, Oregon Health Authority's Drinking Water Services (OHA-DWS) is obligated to conduct evaluations, investigate reports of contamination, and provide written report of findings to water suppliers. These activities are undertaken with the goal of protecting public health. The statute specifically charges the OHA with the following:

- Conduct periodic Water System Surveys of water systems and sources, take water samples, and inspect water system records to ensure the system is not creating unreasonable health risks to customers;
- Provide written report of evaluations (e.g., Water System Surveys, water samples, record inspections) to the local health administrator and to water suppliers;
- Require regular water sampling by water suppliers;
- Investigate any water system that fails to meet the water quality standards established by OHA;
- Investigate reports of waterborne disease pursuant to its authority and to protect the public health and safety;
- Notify the Department of Environmental Quality if water sampling data available to the OHA indicates/identifies an area of groundwater concern.

1.2.2 - Responsibilities of Water Suppliers

All public water suppliers have the important responsibility of providing a safe and reliable drinking water supply to their customers. Responsibilities are defined under OAR 333-061-0025.

These rules charge water suppliers to take all reasonable actions necessary to assure that maximum contamination levels are not exceeded and that requirements governing the operation and maintenance are observed. Overall responsibilities include, but are not limited to the following:

- Submitting plans to DWS prepared by a professional Oregon engineer before undertaking construction of new water systems or making major modifications to existing water systems;
- Collecting and submitting routine water samples for analysis at the required frequencies and report these results to the DWS at the required frequencies;
- Taking corrective actions and notifying customers and the general public in the service area when results indicate maximum contaminant levels have been exceeded, as well as notifying customers when reporting requirements are not being met;
- Maintaining monitoring and operating records that must be available for review during inspections;
- Following up on complaints relating to water quality from users and maintaining records and reports on actions taken in response;
- Maintaining an active cross connection control program;
- Maintaining pressure of at least 20 pounds per square inch (psi) at all service connections at all times;
- Meeting water system operator certification requirements.

1.2.3 – Classification of Public Water Systems

Rules outlined in OAR 333-061 spell out specific requirements for public water systems (PWSs). Requirements vary based on water system classification. Water systems are classified by source and grouped into one of two categories:

- **Surface water** which includes groundwater systems which have been determined to be under the direct influence of surface water **(GWUDI)**, and;

- **Groundwater systems**.

Public water systems are also classified by number of people served and whether the same population is served occasionally versus year-round. The four primary classes of public drinking water systems are:

- **Community Systems (C)** A public water system which has 15 or more service connections used by year-round residents, or services 25 or more residents year-round. (e.g., cities, towns, mobile home parks, residential developments, prisons, etc.);
- **Non-Transient Non-Community Systems (NTNC)** A public water system that is not a community water system, but that serves at least 25 of the same persons over 6 months per year (e.g., schools, businesses, hospitals, etc.);
- **Transient Non-community Systems (TNC)** A public water system that serves an average transient population of 25 persons or more daily, 60 days a year (e.g., parks, restaurants, campgrounds, etc.);
- **State regulated**. **(NP)** A public water system which serves 4 to 14 service connections or serves 10 to 24 people.

Operational and sampling requirements may vary, depending on the classification of a particular system. General sampling requirements may be found on Data Online https://yourwater.oregon.gov/ on the DWS website.

1.2.4 - Sampling and Reporting Requirements

General operating and maintenance requirements outlined in the state rules (OAR 333-061-0205 to 0290) require all community and non-transient non-community water systems meet certification requirements based on system size and complexity specified in state rules.

Small systems with less than 150 connections and using groundwater sources, or purchases its water from a community or non-transient non-community public water system without adding any additional treatment, are classified as “small groundwater systems.”

To comply with requirements for small groundwater systems, systems must employ operators that meet one of the following certification requirements:

- Complete DWS-approved training on small groundwater system operation and water treatment processes, as applicable. or
- Achieve a passing score on a DWS-approved written exam.

***All small system groundwater operator certificates expire every third year on July 31*.** Certificates can be renewed with evidence of completion of the approved small water operator training course. The course is offered around the state throughout the year. The course is also offered online. See the DWS website or contact the DWS for the course schedule or information on accessing the training.

Contract Operators: Water suppliers have the option of contracting for an operator and may contract with a certified water system operator or with another water supplier that has certified operators. Contract operators serving as the direct responsible charge (DRC) operator must be certified at the level equal to or one level greater than the classification of the system.

Owners or representative agents must have a signed contract, between them and the operator, in hand *before the operator may begin services.* Information regarding the differences between hiring a contractor vs. an employee can be found on the Oregon DWS website here: http://www/oregon independentcontractors.com/

There is a list of Oregon operators if you wish to contract out for the work at this website: http://www.oesac.com/

There is a Contract for Services template on the operator certification website under News and Information here: *http://healthoregon.org/opcert* . Please use this template provided for your contract. DWS needs specific language in the contract. Certification for small water system training expires every three years. It is a requirement to submit the Small Water System Operator Designation application.

If an individual contractor operates and/or maintains several SWS's, a separate application and contract is required for each small water system.

1.2.5 - Public Notice

Public notification helps ensure that consumers will always know if there is a problem with their drinking water. Water systems are required to issue public notice when the system fails to comply with the following: Maximum contaminant levels (MCLs), treatment techniques, loss of water pressure, scheduled variance or permit, monitoring and reporting requirements or testing procedures. Special language and basic information must be included in public notices.

Requirements for timeliness of notification and method of delivery (e.g., radio, posting, hand delivery of notices) vary depending on potential impact to public health.

Public notice templates are available from the Drinking Water Services website or from your local health department.

1.2.6 - Consumer Confidence Reports

Consumer Confidence Reports (CCRs) are reports that contain information on the quality of the water delivered by the systems, and characterize in an accurate and understandable manner the potential risks (if any) from exposure to contaminants detected in drinking water.
All community water systems are required to deliver a CCR to their customers annually either by mail or electronically.
Reports must be delivered by July 1 following the reporting year. The water supplier must also submit a certification form to the DWS due October 1. The certification form verifies the report was distributed; the information is correct and consistent with data submitted to the DWS.

A CCR is intended in part to assist the consumer in making informed decisions about their drinking water.

Required components include but are not limited to:

- General water system information;
- Source information (including availability of Source Water Assessment if completed);
- Definitions and explanation of acronyms;
- Concentrations of “most recent” detected regulated contaminants;

- Detections of unregulated contaminants;
- Violations of standards;
- Special language for arsenic, nitrate, lead, cryptosporidium and radon;
- Variances and exemptions;
- Mandatory statements to be included on all CCRs.

A summary of required components, the guidelines and templates, as well as a copy of the CCR certification form are available on the DWS website.

1.2.7 - Water Operator Certification

General operating and maintenance requirements outlined in the state rules (OAR 333-061-0205 to 0290) require all community and non-transient non-community water systems meet certification requirements based on system size and complexity specified in state rules.

Small systems with less than 150 connections and using groundwater sources, or purchases its water from a community or non-transient non-community public water system without adding any additional treatment, are classified as "small groundwater systems."

To comply with requirements for small groundwater systems, systems must employ operators that meet one of the following certification requirements:

- Complete DWS-approved training on small groundwater system operation and water treatment processes, as applicable. or
- Achieve a passing score on a DWS-approved written exam.

<u>All small system groundwater operator certificates expire every third year on July 31</u>**.**

Certificates can be renewed with evidence of completion of the approved small water operator training course. The course is offered around the state throughout the year. The course is also offered online. See the DWS website or contact the DWS for the course schedule or information on accessing the training.

Contract Operators: Water suppliers have the option of contracting for an operator and may contract with a certified water system operator or with another water supplier that has certified operators. Contract operators serving as the direct responsible charge (DRC) operator must be certified at the level equal to or greater than the classification of the system.

Owners or representative agents must have a signed contract, between them and the operator, in hand *before the operator may begin services.* Information regarding the differences between hiring a contractor vs. an employee can be found on the Oregon DWS website here: http://www/oregon independentcontractors.com/ There is a list of Oregon operators if you wish to contract out for the work at this website: http://www.oesac.com/

There is a Contract for Services template on the operator certification website under News and Information here: *http://healthoregon.org/opcert* .

Please use this template provided for your contract. DWS needs specific language in the contract. Certification for small water system training expires every three years. It is a requirement to submit the Small Water System Operator Designation application.

If an individual contractor operates and/or maintains several SWS's, a separate application and contract is required for each small water system.

1.2.8 - Emergency Response Plans

What is an **Emergency Response Plan (ERP)**?

An ERP is a living document that outlines contacts, public operating procedures and actions to minimize impact or potential impact to the drinking water supply from a natural disaster, accident, or intentional act. It helps water suppliers react to emergency situations more quickly.

Having a plan can make a difference in minimizing damage or hazards and can assist in getting a system back to normal operation in a timely manner. All public water systems serving less than 3,300 persons are required to have a current ERP. Reviews and updates must be made at least every five years; however, keeping a plan current is essential.

For small systems, part of developing an ERP includes completing a security vulnerability assessment. Once completed, small systems are required to submit a statement to DWS certifying the ERP is complete and staff is trained to implement the plan. A general fact sheet and guideline for small systems are available on DWS website. (See the resources section).

1.2.9 - Operations and Maintenance Manual

All public water systems must maintain a current Operations and Maintenance Manual. The manual must be updated at least every five years.

Maintaining an updated manual ensures that operations knowledge is retained, even with staff changes. Procedures must include but are not limited to the following:

- Source operation and maintenance;
- Water treatment operation and maintenance;
- Reservoir operation and maintenance;
- Distribution system operation, maintenance and repairs;
- Standard operating procedures for certified operators;
- Record keeping.

When completed, water systems must send a statement to DWS certifying the plan is complete and staff is trained. A fact sheet addressing this requirement is available on the DWS website.

1.2.10 - Capacity Requirements for Public Water Systems

A **capacity assessment** is a comprehensive review of a public water system's technical, managerial, and financial **(TMF)** ability to deliver safe and reliable water to the public.
All public water systems (constructed after October 1, 1999) must submit information providing evidence of TMF capacity as part of the plan review process. Factors evaluated include appropriate permitting, water rights, plan review, land use requirements, initial sampling tests, certified operator, rate structure, and billing procedures.
Capacity assessments are also conducted for systems qualifying for Drinking Water State Revolving Loan Fund. Any identified deficiencies must be corrected prior to allocation of funds.

1.2.11 - Water System Survey

A Water System Survey (sanitary survey) will be conducted on all public water systems, by the state, department of agriculture, or county health department staff approximately every 3 years for community water systems or every 5 years for non-community water systems. A water system survey is a detailed inspection and documentation of a water supplier's water system from the beginning (the source) to the end (the distribution system) and everything in between.

The purpose of this survey is to identify any potential and existing health hazards. Water systems are evaluated for significant deficiencies in well construction, disinfection, treatment, storage, distribution, monitoring compliance, management, and general operations. Any noted deficiencies must be corrected.

See the OAR 061-333-0076 (5) for the fee schedule.

1.2.12 - Plan Review

Prior to construction of a new water system or major additions or modifications to existing systems, the following must be submitted and approved by DWS: construction plans, a plan review fee and a land use compatibility statement from the local planning authority. "Major additions or modifications" mean changes of considerable extent or complexity including, but not limited to, projects involving water sources, treatment facilities (such as filtration and disinfection), finished water storage, pumping facilities, transmission mains and distribution mains. Plans are usually not required for main replacement of the same length and diameter of piping.

For community water systems, plans must be prepared by a professional engineer licensed in Oregon. The engineering requirement may be waived for non-community systems or for non-transient, non-community systems. It is always best to check with the DWS to see what types of plans and fees are required before initiating a project.

OAR Chapter 333 contains Construction Standards that are applicable to these projects. Certification that a project was completed in accordance with the approved plans will complete the plan review process.

If significant changes are made during the course of the work, a set of as-built plans documenting compliance with the Construction Standards will be submitted to finalize the plan review process. Until final approval is issued, the facility is not approved for use.

1.2.13 Drinking Water State Revolving Fund (DWSRF)

Each year, Oregon's Drinking Water State Revolving Fund (DWSRF) offers low interest, long-term financing for needed drinking water infrastructure improvement projects. Projects may be to plan, design and/or construct drinking water facilities needed to increase public health protection and maintain compliance with drinking water quality standards. Publicly and privately owned community and non-profit non-community water systems are eligible to receive funding. Project incentives may include:

- Terms of 20 to 30 years
- Rates of 1% to 4%
- Subsidies (i.e., principal forgiveness & Green Project Reserve incentives)
- Loans up to $6,000,000 (more with Drinking Water Advisory Committee approval)
- 10 hours of free Circuit Rider Technical Assistance (for populations <10,000)
- Letter of Interest (LOI) for infrastructure projects may be submitted year-round

Eligible water systems may also qualify for loans up to $100,000 and for grants up to $30,000 for Drinking Water Source Protection efforts to help carry out elements of a protection plan. Letters of Interest for these types of projects currently are accepted on an annual basis.
To apply, eligible drinking water systems should prepare and submit information about their drinking water system and project(s) on our web-based Letter of Interest (LOI). The LOI may be submitted year-round. Find more information about the LOI at http://www.orinfrastructure.org/LOI-Form/ and if you have questions about the LOI process, contact your Regional Coordinator at http://www.orinfrastructure.org/map.php.

This program is jointly administered by the Oregon Health Authority's Drinking Water Services (OHA-DWS) and Business Oregon's Infrastructure Finance Authority (IFA). Find detailed information on the DWSRF program webpage at http://healthoregon.org/srf.

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FACT SHEET 1.3 - Drinking Water Source Protection

1.3.1 – Understanding Drinking Water Source Protection

1.3.2 – Mechanisms and Potential of Contaminant Threats

1.3.3 – Well Construction and Aquifer Protection Concerns

1.3.4 – Well Drilling Standards

1.3.5 – Finding a Well-Drilling Contractor

1.3.6 – Using the Source Water Assessment Tool

1.3.7 – Benefits and Incentives for Source Water Protection

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 1.3 - Drinking Water Source Protection

1.3.1 - Understanding Drinking Water Source Protection

Amendments made in 1986 and 1996 to the federal Safe Drinking Water Act (SDWA) required all states to develop **Drinking Water Protection Programs** for those water systems using groundwater (originally referred to as Wellhead Protection) and surface water. In Oregon, this mandate became part of the state's overall **Drinking Water Protection Program (DWPP)** for both groundwater and surface water systems. The DWPP is jointly administered by the Oregon Department of Environmental Quality (DEQ) and the DWS.

The goal for a Drinking Water Protection Program is to "protect source water areas from contaminants which may have any adverse effect on the health of persons." This goal is achieved when each public drinking water system develops and implements a "drinking water protection plan" an organized approach to effectively protect their drinking water supplies. Recent years have seen a shift towards water systems developing a collection of protection strategies (based on identified risks) rather than pursuing the full "drinking water protection plan" process.

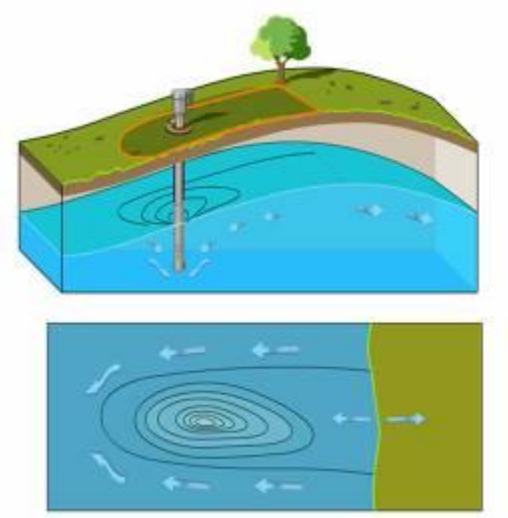
An important part of the 1996 amendments required states to conduct **Source Water Assessments (SWA)** for all federally defined water systems in their boundaries. A SWA comprises the following elements: identifying the source area for the water, inventorying the potential contaminant sources (PCS) within that area, and evaluating the susceptibility of the water system to those potential contaminants. This information provides the basis for a water system to develop a protection plan tailored to their specific needs (see further discussion in Section 1.3.6 below).

1.3.2 - Mechanisms and Potential of Contaminant threats

For groundwater-based systems, beginning a Source Water Assessment would include consideration of the geology, well(s) depth(s) and slope or flow direction of groundwater. In Oregon, the protection area is referred to as the **Drinking Water Source Area (DWSA)**.

The **water table** is the upper surface of the saturated zone (top of the water surface underground). Groundwater tends to move from areas where the water table is high to areas where it is low.

Pumping wells can have a significant influence on the direction and rate of groundwater flow because the drawdown they produce changes the shape and slope of the water tab



When a well is turned on, it lowers the water table in its vicinity and intercepts water that flows in from higher water tables towards the well. This water can move sideways as well as up or down in response to differences in gravity, elevation and pressure.

This creates a "**capture zone**" above or in the aquifer (see illustration above), which is the part of the aquifer that supplies water to the well. Any water or contaminant that is in the capture zone will move towards the drawdown area.

It is not necessary for a contaminant to actually reach the groundwater itself; the percolating water is capable of transporting it to the aquifer.
The area on the ground surface where a contaminant is released and may be transported by the flow of groundwater to a drinking water source (well, well field, or spring) is known as the DWSA.

Once the capture zone is delineated (or determined), possible contaminants within the zone must be identified, assessed and mitigated if necessary.

DWSA contaminants of concern include: microorganisms (bacteria, viruses, *Giardia*, etc.), inorganic chemicals (nitrate, arsenic, metals, etc.) and organic chemicals (solvents, fuels, pesticides, etc.).

When investigating the protection area, some potential contaminant sources such as landfills, gas stations and agricultural areas are easy to spot.

Awareness of not-so-obvious potential contaminants such as septic systems, lawn fertilizers, pesticides, and storm water runoff is very important.

It is also important to note that very small amounts of some chemicals can contaminate large quantities of water.

1.3.3 - Well Construction and Aquifer Protection Concerns

Because so much can be done to limit or reduce the risk of contamination during new well siting and construction, a DWPP includes developing procedures for planning and siting new wells. Such procedures include:

1. ***Finding the best location****.* A well must meet desired capacity with good quality water that requires minimal treatment.
2. ***Research***. The amount of water in an aquifer depends on topography, geology, annual rainfall and distance to other water sources. Check with local well drillers, neighboring property owners or well logs for the desired area.
3. ***Well logs***. Well logs are part of well reports that are required by Oregon law and prepared by well drillers. The logs provide information regarding geological conditions and yields as well as details about well design and construction. The Oregon Water Resources Department (WRD) (*www.wrd. state.or.us*) has most of the well logs for wells drilled since 1955 on file. Submit well logs for an area during the planning stage to allow DWS to make recommendations regarding the construction and sealing of the well.

A preliminary potential source contamination assessment also must be conducted for each site. These assist in choosing the best long term site.

Once a source has been found, it is important to estimate water needs based on peak day demands. Peak demand usually occurs at the beginning of the day or in the evenings.

Peak demand estimates should include conditions similar to a long hot summer day, when other activities such as irrigation and automobile washing are likely. Oregon WRD has an easy-to-understand guide to estimating water use for various home and farm activities. Domestic systems require storage tanks to stockpile water for use during periods of high demand.

Wells should be located in pollution free areas. Local well drillers who have knowledge of and experience with state regulations should be able to help site a well. If possible, a well should be located close to where it is needed and near a source of electricity.

State standards also dictate wells must be located:

- Away from septic systems, stock yards or other sources of contamination;
- Farther from potential hazards in highly permeable areas (sand and gravel)
- With drainage running away from the well;
- Far enough from other buildings to allow maintenance practices;
- In an area not prone to flooding;
- A reasonable distance from neighboring wells;
- A safe distance from property lines.

The Oregon Utility Notification Center (800-332-2344) must be notified at least two business days before any well-digging begins.

1.3.4 - Well Drilling Standards

WRD sets well drilling standards designed to protect public health and groundwater sources. A copy of well construction standards (OAR 690-200 through 690-230) can be found on WRD's website. If site conditions do not allow for construction (or abandonment) of a well in a suitable location, a water purveyor must obtain a "special standard" from the WRD.

Prior to drilling a new well, public water systems are also required to notify DWS and obtain approval for their construction plan (OAR 330-061-0060). DWS may set additional standards regarding the construction of the well.

1.3.5 – Finding a Well-Drilling Contractor

Licensed and bonded well-drilling contractors can be found through:

- The WRD website (*www.wrd.state.or.us*);
- The Oregon Ground Water Association;
- Phone books;
- Neighbors;
- WRD's central office.

It is extremely important to check well-drilling contractors' references.

1.3.6 - Using the Source Water Assessment Tool

As stated previously, states are required under 1996 amendments to the Safe Drinking Water Act to conduct **Source Water Assessments (SWAs)** for federally recognized public water systems that fall under state regulatory authority. In Oregon, groundwater system assessments are conducted by DWS, while surface water system assessments are conducted by DEQ. SWAs include three primary elements:

(1) *Delineation.* Identification of the Drinking Water Source Area (DWSA), which for groundwater systems would be the area that directly overlies that part of the aquifer supplying drinking water to the well or spring.

(2) *Inventory.* An inventory of potential contaminant sources (PCSs) in the DWSA.

(3) *Susceptibility.* Identification of which contaminant sources in the DWSA the drinking water source is most susceptible to.

Once the Source Water Assessment is complete, the *"protection phase"* of the program can be carried out by water system personnel and the community. The protection phase includes:

- Reviewing the SWA and enhancing it if necessary;
- Preferably, assembling a local drinking water protection team, consisting of individuals that have an interest in, or may be impacted by, management strategies within the DWSA.
- Developing a plan to reduce identified risks of contamination;
- Developing a contingency plan to address potential loss of the drinking water supply during an emergency;

DEQ and DWS recommend that during the detailed review of the SWA, the system should clarify the presence, location, operational practices, actual risks, etc., of identified facilities and land use activities in the DWSA. Community resources should be used to perform an "enhanced inventory" to refine the primary list of potential contamination.

SWAs are an important tool to support water systems and communities that decide to move to the next phase of protection. Once potential contaminant sources (PCSs) are identified in a drinking water source area, water systems are strongly encouraged to implement strategies that will manage those risks. These strategies commonly involve adopting **Best Management Practices (BMPs),** designed to reduce the risk from specific contaminants. When developing a protection strategy, screen out contaminant sources that pose little or no threat to the drinking water source. For example, if land use practices or activities within the protection area already operate in a manner to reduce risks of contamination, re-evaluation of practices may not be necessary. The objective of a protection strategy is to address an activity or practice that poses moderate or high risk to a public water supply.

Some systems may choose to develop a broader drinking water protection plan that addresses all identified risks and includes all elements defined by the 1986 SDWA source water protection amendments (see below).

Whether implementing protection strategies or a more formal protection plan, the purpose is the same - to reduce the risk of contaminating drinking water supplies. With few exceptions, either approach is compatible with most land uses. The best approach is to involve property owners early in the process. Respecting their concerns and communicating the importance of protecting drinking water is vital to implementing successful protection strategies or plans.

Protection planning also includes making a contingency plan that outlines actions to take and backup supply options in the event of a contamination incident and/or loss of supply. Options may include utilizing another nearby water source or forging an agreement with a neighboring water system. The Emergency Response Plan required of all public water systems (see Section 1.2.8) covers much of the same material.

If the water system wishes to have DEQ certify the plan, a written plan report should be submitted which contains:

- An introduction describing how the planning process was initiated in your community, background information on the local area and government entities and roles within the protection area;
- A delineation map of the Drinking Water Source Area;
- An inventory of potential contaminant sources.
- Management actions to address potential contamination sources;
- A description of the emergency contingency plan;
- Procedures for planning and siting of new public water system wells or springs;
- Public participation efforts used in the development of the plan.

Send the report to:

Oregon Department of Environmental Quality
Water Quality Division, Drinking Water Protection Coordinator
811 SW 6th Avenue
Portland, OR 97204

More steps detailing how to develop a Drinking Water Protection Plan are outlined in Oregon Wellhead Protection Guidance Manual (1996). The manual, along with other pertinent information, can be viewed at: http://www.deq.state.or.us/wq/whpguide/frontpage.htm

Click on the link and follow the line that says 'Go to table of contents'; from there you can open the different sections of the subject outline.

Limited technical assistance for systems that choose to voluntarily develop protection plans is available through DEQ and DWS. For more information and help, contact DEQ/DWS Drinking Water Protection Specialists:

- DEQ 503-229-5413
- DEQ 503-229-6210
- DWS 541-726-2587

1.3.7 - Benefits and Incentives for Source Water Protection

Development of a certified DWPP is voluntary, so why go the extra effort? Benefits and incentives for developing a plan include:

Prevention of contamination - Preventing contamination from happening is more cost effective than investigation and treatment costs associated with a contamination event. In the early 1990's, the Oregon DEQ and DWS compared the costs of prevention versus treatment for a small Oregon community (population 330) whose water had been impacted by a volatile organic contaminant exceeding the drinking water limit. The estimated cost of prevention was less than $15 per resident, while the actual cost of investigation and treatment was more than $1500 per resident. Those were in 1990's dollars; the costs can only have increased dramatically during the years since.

Reduced monitoring requirements - Routine monitoring for organic chemicals (e.g., fuels, solvents and pesticides) must take place at least once every three years. Cost of monitoring is approximately $1750/source. A state-certified plan may allow a system to reduce monitoring from once every three years to once every six years. Such a reduction can mean a substantial savings for small systems or systems with multiple separate sources.

Access to special funding for implementation of protection strategies - Water systems in the process of developing or implementing drinking water protection strategies have access to loan funds and grants through the Source Protection Loan Fund. (See http://HealthOregon.org/SRF).

Additional credit when applying for funding from the Drinking Water State Revolving Loan Fund - Water systems applying for loans for capital improvements through the state revolving fund are awarded additional credit for implementing source protection strategies and/or developing drinking water protection plans.

Source Water Assessment Reports are the foundation for developing drinking water protection plans. They contain much of the baseline information needed to develop a plan. DEQ and OHA have issued over 1,500 Source Water Assessment Reports to Oregon public water systems. They identify important areas, locate potential contaminant sources, and define areas where the drinking water is must susceptible. Source Water Assessment Reports are a valuable source of information that naturally leads to development of protection strategies.

UNIT 1: Essential Information and Considerations

FACT SHEET 1.4 - Identifying and Correcting Significant Deficiencies

1.4.1 - What is a Significant Deficiency?

FIGURE - Significant Deficiencies / Drinking Water Regulation Violations

1.4.2 - What is a Water System Survey?

1.4.3 - Utilizing Information from the Water System Survey / Addressing Deficiencies

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 1.4 - Identifying and Correcting Significant Deficiencies

1.4.1 - What is a Significant Deficiency?

A significant deficiency is any condition in a water system that creates a reasonable threat of water contamination or a water outage. It could be a physical condition, a flawed operational procedure or a missing planning element that puts the system at risk.

Public water system operators must be able to identify significant deficiencies. This requires knowledge of the water system, common sense, accurate information and on-going diligence. If a significant deficiency is identified, it is an operator's responsibility to take the steps needed to correct the problem.

All water systems should have the authority (via rules, regulations, ordinances or resolutions) to make the necessary corrections.

A **Water System Survey** is one tool that helps identify the presence of significant deficiencies. Water System Surveys are conducted either by the DWS or your local health department staff and are further described in 1.4.2 below.

Types of deficiencies to look for in groundwater systems include:

- Well construction;
- Spring/other source;
- Disinfection;
- Treatment;
- Finished water;
- Distribution system;
- Monitoring compliance;
- Management.

A summary of the most common significant deficiencies is shown in **FIGURE 1.4.1**.

FIGURE 1.4.1 - Significant Deficiencies / Drinking Water Regulation Violations
(√ if item has been resolved)

Deficiencies related to surface sources:
- ❑ Turbidity standards not met
- ❑ Turbidimeters not calibrated per manufacturer or at least quarterly
- ❑ Incorrect location for compliance turbidity monitoring
- ❑ No auto-dial call-out alarm or auto-plant shut-off for low chlorine residual (H >3300 population) or high turbidity when no operator is on-site
- ❑ For conventional or direct filtration: Settled water turbidity not measured daily
- ❑ For conventional or direct filtration: Turbidity profile not conducted on individual filters at least quarterly
- ❑ For cartridge filtration: No pressure gauges before and after cartridge filter
- ❑ For cartridge filtration: Filters not changed according to manufacturer
- ❑ For diatomaceous earth filtration: Body feed not added with influent flow
- ❑ For membrane filtration: Turbidimeter not present on each unit;
- ❑ For membrane filtration: Direct integrity testing not done at least daily.

Well construction deficiencies
- ❑ Sanitary seal and casing not watertight
- ❑ Does not meet setbacks from hazards
- ❑ Wellhead not protected from flooding
- ❑ No raw water sample tap
- ❑ No treated sample tap, if applicable
- ❑ No screen on existing well vent

Spring / other source deficiencies
- ❑ Spring-box not impervious durable material
- ❑ No watertight access hatch / entry
- ❑ No screened overflow
- ❑ Does not meet setbacks from hazards
- ❑ No raw water sample tap
- ❑ No treated sample tap (if applicable)

Disinfection deficiencies:
- ❑ DPD type test kit not used
- ❑ Free chlorine residual not maintained
- ❑ Chlorine not measured and recorded as required
- ❑ Minimum CT requirement not met all times
- ❑ No means to adequately determine flow rate on contact chamber effluent line

- ❑ No means to adequately determine disinfection contact time under peak flow and minimum storage conditions
- ❑ Failure to calculate CT values correctly
- ❑ pH, Temperature, and chlorine residual not measured daily at first user
- ❑ For UV: Bypass around UV system
- ❑ For UV: Lamp sleeve not cleaned
- ❑ For UV: Lamp not replaced per manufacturer
- ❑ For UV: No intensity sensor with alarm or shut-off
- ❑ For UV: Annual raw water sampling past due

Treatment deficiencies:

- ❑ Non-NSF approved chemicals
- ❑ Corrosion control parameters not met

Finished water storage deficiencies:

- ❑ Hatch not locked or adequately secured
- ❑ Roof and access hatch not watertight
- ❑ No flap valve, screen or equivalent on drain
- ❑ No screened vent

Distribution system deficiencies:

- ❑ System pressure < 20 psi
- ❑ Cross-connection:
- ❑ No ordinance or enabling authority (CWS)
- ❑ Testing records not current (CWS, NTNC, TNC)
- ❑ No Cross Connection Control Specialist (CWS, >300)
- ❑ Annual Summary Report not issued (CWS)

Monitoring Compliance:

- ❑ Monitoring not current
- ❑ MCL violations
- ❑ No written coliform sampling plan

Management deficiencies:

- ❑ No operations and maintenance manual
- ❑ Emergency response plan not completed
- ❑ Major modifications not approved (plan review)
- ❑ Master plan not current (> 300 connections)
- ❑ Annual CCR not submitted (CWS)
- ❑ PNC or out of compliance with AO
- ❑ Public notice not issued as required

Operator Certification

- ❑ No certified operator at required level
- ❑ No written protocol for under certified operator

Source: OHA-Drinking Water Service

1.4.2 – What is a Water System Survey?

A **Water System Survey** is a detailed water system inspection conducted by staff of the DWS or the county health department. The survey evaluates all parts of the system, starting with the source, pumping, treatment, and storage facilities, on through the distribution system to service connections. The surveys are used to identify and correct sanitary deficiencies and are indispensable for ensuring the delivery of safe water on a sustainable basis.

Inspections for all public water systems are generally conducted every five years for non-community water systems and every three years for community water systems. Areas of inspection for groundwater supplies include:

- Setback area from potential hazards around the wellhead;
- Potential sources of pollution;
- Sanitary seals;
- Whether wellhead terminates above grade;
- Raw water sample tap.

The well house or pumping station is a key part of the survey for groundwater systems. The pumping station should be enclosed within a secure building that will prevent entry of natural and manmade contaminants. The survey will address such questions as:

- Can the building be locked?
- Is there an alarm or security system?
- Are unapproved chemicals stored in the building?
- Is the chemical feed system (if any) safe from vandals?
- Is the general housekeeping appropriate?

The water system survey will also include an inspection of the distribution system. Because much of this system is buried and can't be seen, it is important to check file records or with local officials to document the types, sizes and life expectancy of all pipes and valves located underground.

In a distribution system, an important concern for a water system operator is cross connections that may contaminate water supplies. Distribution system questions to consider include:

- Are backflow devices installed on properties with unapproved sources of water?
- Are backflow devices installed on properties with known cross connections?
- Are fire hydrants inspected regularly?
- Are only trained individuals using the fire hydrants?
- Is a flushing program in place?
- Are all water meters protected (box for customers, locked for master meters)?
- Are valves exercised and maintained?

If there are storage facilities, concerns include:

- Are storage tank vents and overflow pipes screened?
- Are storage tank hatches locked and sealed?
- Are storage facilities regularly inspected and cleaned as needed?

1.4.3 – Utilizing Information from the Water System Survey / Addressing Deficiencies

Once a Water System Survey has been performed, all deficiencies or potential deficiencies must be addressed. A plan to resolve or correct deficiencies including a schedule to execute the plan must be developed.

Surface water systems and groundwater systems under the influence of surface water (GWUDI) must respond to DWS within 45 days with a plan that outlines how and when any identified deficiencies will be resolved.

Groundwater systems must respond to DWS or County Health Department within 30 days, and by 120 days after notification of survey results, they must have either corrected all significant deficiencies or be on an DWS-approved correction plan.

If a system fails to do so, it must issue a public notice to users advising of that failure and then must submit the plan and timetable as originally required. Failure to do so may result in a fine for non-compliance.

UNIT 1: Essential Information and Considerations

FACT SHEET 1.5 - Identifying and Resolving Cross-Connections

1.5.1 - What is a Cross-Connection?

1.5.2 - Oregon Cross-Connection Control / Backflow Prevention Program

1.5.3 - Evaluating for Cross-Connections

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 1.5 - Identifying and Resolving Cross-Connections

1.5.1 - What is a Cross-Connection?

A **cross-connection** is any actual or potential connection between a potable water supply and non-potable water or other substance. A cross-connection may contaminate the water supply by backflow.

Backflow refers to the reversal of the normal direction of flow in piping. Backflow is caused by:

- **Backpressure**, flow of non-potable water or other substance into the water system from connections that are higher pressure than the water system; or
- **Backsiphonage**, siphoning of non-potable water or other substance into the water system due to negative pressure or reduced pressure in the water supply piping.

Backflow may be created by many situations. Under normal working pressures most cross-connections occur when the water from the unknown source is at a higher pressure than the pressure in the water system. This could occur when a customer uses a private well or booster pump or when there's a drop in system pressure caused by a large break in the line, or when the lines are being flushed, or by fire trucks pumping large amounts of water for fire fighting. The reduced pressure can also produce a siphon which can draw water out of chemical tanks, air conditioners, hot water heaters or any appliance with a submerged inlet that is not protected to prevent backsiphonage.

There are numerous, well-documented cases where cross-connections have been responsible for contamination of drinking water. For example, in 1999 in Texarkana, Arkansas backflow from the air conditioning system at a local school entered the school's waterlines because the heat exchanger operated at a higher pressure than the municipal water system and the heat exchanger was either not properly protected or the backflow assembly prevention failed. Fortunately, discoloration of the water was observed early and the school was instructed not to drink or use the water and no one became ill. Preventing and addressing cross-connections is an important factor in protecting the water supply from possible contamination. At a minimum, all public water suppliers must be familiar with the dangers of cross-connections and should exercise careful surveillance of their systems.

1.5.2 - Oregon Cross-Connection Control / Backflow Prevention Program

In Oregon, the Cross-Connection Control/Backflow Prevention Program is administered by DWS.

By state law, public water system operators are required to prevent cross-connections from existing within their systems. If an actual or potential cross-connection exists, installation of an approved backflow prevention assembly is required. Water systems can meet these requirements by conducting ongoing evaluations for cross-connections as described in section 1.5.3 below.

All community water systems are also required to carry out a local cross-connection program. In addition to ongoing evaluations, this includes:

(1) ***Enabling authority***. All community water systems must have a rule, by-law, resolution, or an ordinance covering cross-connections. The document should make clear how the system will assure compliance with cross-connection requirements. The document should also state what steps the system will take to identify cross-connections, what will happen when cross-connections are discovered, the process by which each backflow assembly will be installed and tested, how testing will be documented and how non-compliance will be handled. The resolution or ordinance should include authority to inspect suspected cross-connections, as well as the clear authority to discontinue water service to customers who do not eliminate a cross-connection where possible, or fail to install, repair if necessary and annually test backflow devices.

(2) ***Testing program and record keeping**.* A mechanism should be established to ensure that all backflow assemblies within the system are tested and maintained by a state certified tester on an annual basis. These records should be kept for a period of ten years. Records listing all connections within a water system that could have potential cross-connections should also be kept for as long as the conditions exist.

(3) ***The Cross-Connection Annual Summary Report*** is required for all community water systems

(4) in Oregon. In it, community water systems must report the progress of their cross-connection control program to DWS. This report is supplied by the state and must be filled out by the system's cross-connection Specialist. It is due each year before the last business day of March for the previous year's reporting period of January 1 to December 31.

For more information including regulations, forms, a list of approved backflow assembly devices, available cross-connection related training courses, and list of certified backflow assembly testers visit the DWS web site at: *http://www.healthoregon.org/crossconnection*

Or contact: (971) 673-1220

1.5.3 - Evaluating for Cross-Connections

All public water systems should be in the practice of conducting evaluations for cross-connections. Systems may contract with a certified cross-connection specialist or perform the work themselves with guidance from DWS.

The first step in the evaluation process is to determine what types of customers receive water service. If strictly residential, it should be determined if any of the connections has another source of water such as a private well, swimming pool, pond, or water-using equipment such as medical equipment, photo labs, etc. If there are any commercial or industrial connections, determinations must be made as to whether alternative water sources or any physical, biological, or chemical contaminants are being used in such a way that with the right hydraulic conditions could enable them to enter the water system.

Water system operators must investigate properties within the system where potential cross-connections are suspected. Some types of service connections that could potentially contaminate water systems through a backflow incident are:

- Wastewater treatment plants or pumping stations;
- Domestic booster pumps;
- Hospitals, clinics or mortuaries;
- Fire-fighting systems (building sprinklers);
- Irrigation systems;
- Private groundwater wells or other alternate sources of water;
- Swimming pools, hot tubs or ponds;
- Car washes;
- Photo labs

A thorough list of high hazards is at OAR 333-061-0070 (17) (i) in Table 48.

Where an actual or potential cross-connection is identified, installation of a backflow prevention assembly is required. The assemblies must be tested at least annually by a state certified backflow assembly tester or if they are moved or repaired.

UNIT 2: Sampling & Reporting

FACT SHEET 2.1 - Understanding Standards

2.1.1 - What are Drinking Water Standards?

2.1.2 - Maximum Contaminant Levels / Important Standards

2.1.3 - Action Levels (Lead and Copper)

2.1.4 - Alert Levels for Further Testing

2.1.5 - Interpreting Test Results / Units of Measure

2.1.6 - Other Useful Standards

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 2.1 - Understanding Standards

2.1.1 - What are Drinking Water Standards?

Standards are set for contaminants that are known to occur in water, are detectable in water and may cause a health or aesthetic problem.

Drinking water standards limit the amount of contamination to a level considered "acceptable".

The US Environmental Protection Agency (USEPA) is the federal agency responsible for setting national drinking water standards.

When setting standards, USEPA uses the latest available research data on health effects and also takes into account the feasibility and cost of analysis and treatment.

USEPA sets these standards, but it is up to the Oregon Health Authority (OHA) to enforce them in their role as the primacy agent. It is the responsibility of the water supplier to ensure that finished water, any chemicals used and equipment meet the appropriate standards.

Following are some of the different types of test standards used in Oregon.

2.1.2 - Maximum Contaminant Levels / Important Standards

Two types of drinking water standards are used for testing: primary and secondary.

Primary standards are set for contaminants that may cause health problems. It is mandatory that public water systems adhere to the primary standards.

Maximum Contaminant Levels (MCLs) are established for primary standards. An MCL is the maximum amount of contaminant that can be present in water, and still be considered safe to drink.

Secondary standards are created for water contaminants that cause aesthetic problems such as bad taste, discoloration or odor (ex: iron, manganese, sulfur). These standards are not enforceable.

2.1.3 - Action Levels (Lead and Copper)

ACTION LEVEL

- Requires additional steps to be taken!

EXCEEDING AN ACTION LEVEL may require:

- Customer notification (sometimes immediately)
- Additional testing
- Installation of equipment to reduce the contaminant

Instead of an MCL, some contaminants (lead and copper) have a limit called an **Action Level** that, if exceeded, requires the water supplier to take additional steps.

Depending on the contaminant, exceeding an Action Level may require customer notification, additional testing and/or eventually require installation of equipment to reduce the contaminant.

2.1.4 - Alert Levels for Further Testing

ALERT LEVEL

- Health risk, immediate action is required so contaminant does not reach the MCL!
- Set at ½ MCL for inorganic chemicals
- Zero tolerance for any organic chemicals

Any time an Alert Level is Met or Exceeded:

- Inform DWS or inform the County Health Office

In addition to standards, the USEPA has also identified **Alert Levels.** An alert is generated when a contaminant level is greater than one-half the MCL for any inorganic chemicals, and any detection whatsoever for any volatile organic chemicals (VOCs) or synthetic organic chemicals (SOCs).

The water supplier must notify DWS or the relevant county health authority if a test result is at or above an alert level.

Because of the associated health risks, more frequent testing will be required for any chemical that exceeds the alert level.

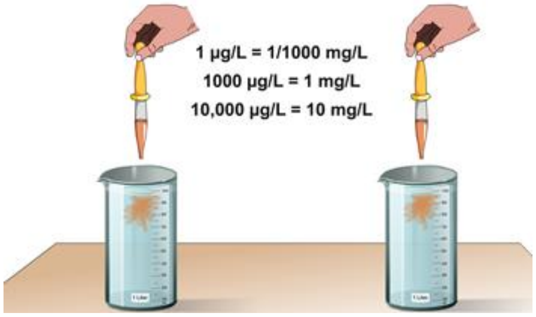
2.1.5 - Interpreting Test Results: Units of Measurement

All drinking water test results and standards have a unit of measurement associated with them. Most tests indicate units of weight of the contaminant per volume of water. The most common unit is the **milligram per liter (mg/L)**, which expresses the weight, in milligrams, of a contaminant in every liter of water (A liter is slightly more than a quart.).

Some laboratories prefer to use **parts per million (ppm)**, which is equal to milligrams per liter of water (i.e., 1 ppm = 1 mg/L).

Some contaminants that can be measured in extremely small quantities are reported in **micrograms per liter (µg/L),** which are identical to **parts per billion (ppb)** (i.e. 1 ppb = 1 µg/L).

Concentrations expressed in mg/L (or ppm) can be converted to µg/L (or ppb) by multiplying by 1,000. Also µg/L (or ppb) can be converted to m mg/L (or ppm) by dividing by 1,000.



For example:

4 ppm is the same as 4 mg/L; which is the same as 4000 µg/L; which is the same as 4000 ppb.

2000 ppb is the same as 2000 µg/L; which is the same as 2 mg/L; which is the same as 2 ppm.

Although most water quality measurements are expressed in these units, some tests — such as those for bacteria and radiation — use different units. These special measurements are described later in this unit.

2.1.6 - Other Useful Standards

There are a variety of U.S. organizations, composed of various professional and stakeholder organizations that develop appropriate drinking water standards to ensure reliability, quality of products, and to protect the public health. These include:

American
r Works
ociation

American Water Works Association

American National Standards Institute

ANSI Accredited Certification Program

The National Sanitation Foundation

The Water Quality Association (WQA)

These four are the better known organizations that produce standards for chemicals, pipes and equipment that come into contact with potable water.

Any water system equipment must be certified by NSF or

ANSI as being appropriate for potable water. Typically, the appropriate standard number will be printed on the side of the pipe or on the equipment data plate.

The NSF Water Distribution Systems Program is responsible for certifying drinking water treatment chemicals and system components to ensure that these products do not contribute contaminants to drinking water that could cause adverse health effects. The NSF standards are:

- **NSF/ANSI Standard 60: Drinking Water Treatment Chemicals -- Health Effects**: the nationally recognized health effects standard for chemicals used to treat drinking water.
- **NSF/ANSI Standard 61: Drinking Water System Components -- Health Effects:** the nationally recognized health effects standard for all devices, components and materials which come in contact or are used to provide drinking water.

UNIT 2: Sampling and Reporting

FACT SHEET 2.2 - Sampling and Reporting Requirements for Small Groundwater Systems

(Contains edited excerpts from 40 CFR 141.201)

2.2.1 - Overview of Sampling and Reporting Requirements

2.2.2 - Coliform Sampling FAQs

2.2.3 - Inorganic Chemical Sampling FAQs

2.2.4 - Organic Chemical Sampling FAQs

2.2.5 - Radionuclides

2.2.6 - Disinfection By-Products (DBP)

2.2.7 - Regulatory Changes

2.2.8 - Using the OHA DWS Website

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 2.2 - Sampling and Reporting Requirements for Small Groundwater Systems (Contains edited excerpts from 40 CFR 141.201)

This fact sheet summarizes sampling and reporting requirements for small groundwater systems. It also addresses why certain tests are needed, testing requirements and test taking methods. In addition to knowing what tests to take and when, understanding correct sampling techniques is very important. If a sample is collected improperly, results may not accurately reflect water quality, *and could require multiple retake samples -- a waste of both time and money.*

2.2.1 - Overview of Sampling and Reporting Requirements

Why test?
By law, all public water systems are required to regularly test water quality. State and federal requirements determine the type and frequency of tests. Water testing provides information to both water suppliers and their customers concerning the overall quality of the drinking water, and also detects water quality problems that need to be addressed.

Failure to conduct these mandatory tests could result in:

- Customer health problems;
- A compliance violation(s);
- Financial penalties against the water supplier.

Testing responsibility is usually not understood by customers, and is therefore often unappreciated. You, as an operator or owner, should make a strong effort to educate your customers, board and council or commission on the importance of the water quality testing program and your efforts to comply.

Who can test drinking water?
It is the responsibility of the **Water Supplier** to see that samples are taken in accordance with federal and state requirements. Basically, anyone familiar with recommended procedures may collect the various samples. Most often this is the operator, or someone trained by the operator.

What must be tested?
Depending on your water system classification (community, transient, etc.), various tests are required at specified frequencies. Among the tests that may be

conducted by small groundwater systems are:

- Microbial or coliform;
- Inorganic chemicals;
- Organic chemicals: volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs);
- Radiological;
- Disinfection by-products (DBPs).

Specific information about these contaminants and required sampling procedures are included in this document.

How often do I test?
Knowing which water quality tests to take and when to take them can be confusing. The number of required tests may be impacted by each water source's susceptibility to contamination, water quality history, compliance with previous monitoring requirements and waiver status. There is also a long list of required tests to perform. The frequency of microbial testing depends on the population served. For example, community groundwater systems serving a population of less than 1,000 must take one routine coliform sample per month. Generally, non-community systems must take quarterly samples. Your particular sampling schedule has been determined by your system classification.

Chemical sampling frequencies vary greatly by contaminant. Some chemical tests are required annually, while others require a single test during a three-year period. Depending on various factors (your test results, compliance with previous monitoring requirements, susceptibility to contamination and development of a **Drinking Water Protection Plan and Program)**, some testing frequencies may be reduced.

Detailed descriptions of monitoring requirements can be found in the Oregon Administrative Rules (OAR 333-061-0036).

For Oregon public water systems, a summary fact sheet of required chemical tests is available from DWS and included in the reference section of the Monitoring & Reporting Forms web page. (See Section 2.2.8 for further information).

What laboratory can I use?
All water quality tests must be sent to a **State Certified Laboratory** for analysis**.** Using a certified lab assures the water supplier, customers, and DWS, that tests are being analyzed

following accepted laboratory practices and that results are dependable.

A list of certified labs throughout the state of Oregon can be found on the DWS website – [*State Certified Laboratories*.]

Do I need to report results?
YES. Once tests are taken, the next step is to ***report the results to DWS***. The water supplier is responsible for assuring results are reported to DWS no later than 10 days following the end of the required monitoring period. The water supplier may choose to report results to DWS directly, or may make arrangements with their lab to report the results to DWS in a timely manner.

When a maximum contaminant level is exceeded, results must be reported to OHA more quickly. In addition, water suppliers may be required to submit **public notice** to consumers. (See 2.3 – *Public Notification Requirements* for more information.)

All community water systems also must report the results of any tests that show detections of regulated contaminants to customers in an annual **Consumer Confidence Report (CCR)**. The rationale for a CCR is that consumers have a right to know what is in their drinking water. (See 2.4 – *Consumer Confidence Reports* for more information.)

2.2.2 - Coliform Sampling FAQs

Why test for coliform* bacteria*?

Coliform bacteria commonly occur throughout the environment. They are used as an **indicator organism** to determine the potential for the presence of disease-causing (**pathogenic**) organisms in water. If coliform bacteria are present, a contamination pathway presumably exists between the bacteria source and the water supply. Disease-causing bacteria may use this pathway to enter the water supply. Since coliform bacteria stay in water longer than most disease-causing organisms, the absence of coliform bacteria leads to the assumption that the water supply is microbiologically safe to drink. Results from coliform bacteria tests are normally expressed as "Present" or "Absent".

When a coliform test is positive, additional tests for fecal coliform bacteria and *Escherichia coli* (*E. coli*) are conducted. **Fecal coliform** are a smaller group of bacteria within the coliform bacteria type specific to the intestinal tracts of warm-blooded animals. ***E. coli*** is a type of fecal coliform bacteria commonly found in the intestines of animals and humans. A positive *E. coli* result is a strong indication that human sewage or animal waste has contaminated the drinking water.

Which coliform samples must be taken and when?

For **community** water systems using groundwater, **bacteriological testing** in the distribution system — also known as a "bacti" or **total coliform (TC)** test — must be conducted every month. The number of monthly samples depends on the size of the system.

Community systems serving populations of up to 1,000 must conduct one routine sample per month. **Non-community** water systems using groundwater that serve populations of less than 1,000, routine samples are required quarterly. For those that serve populations greater than 1,000, monthly samples are required.
The drinking water standard requires that ***no coliform bacteria are present in public drinking water supplies.***

It is strongly advised that coliform samples be taken within the first two weeks of the month. Doing so allows for **repeat samples** to be taken within the same month or monitoring period, which is a federal requirement. It is important to properly identify on the laboratory form the type of sample collected.

In all, there are **six (6) types of microbial samples**. The first four – the most common - are taken from the distribution plumbing of the water system. The source samples defined below are part of the Groundwater Rule.

Types of Distribution Samples:

1. Routine Samples
Regular coliform samples are collected on a monthly (or quarterly) basis. Collection procedures, including sample sites, should be in accordance with an approved **Coliform Sampling Plan** (see following sections of this document).

2. Repeat Samples
Repeat samples are collected following a “coliform present” routine sample result. If a system routinely collects one coliform sample per month or quarter, the number of repeat samples taken is four (or three beginning in 2016 under the Revised Total Coliform Rule, RTCR). These sites should be identified on the coliform sample site plan. If a system takes two or more routine samples per month, the number of repeat samples is three for every “coliform present” sample result.

3. Special Samples
Special samples are not required, but may be collected for the benefit of the water system. For instance, a “special” sample would be collected after repairs to the system and before it is placed back into operation; or a sample collected at a wellhead prior to disinfection.

4. Temporary Routine
Temporary routine samples are different from regular routine samples in that they are required during the month following a positive routine sample. They represent a temporary increase in number of required routine samples**.**

Types of Source Samples:

1. Triggered Sample
Triggered samples test the untreated source water (from a well or spring) for coliform bacteria when "triggered." The trigger is a positive (present) result from a routine coliform sample in the distribution system. All groundwater systems are subject to the triggered monitoring requirement under the Groundwater Rule (GWR) *unless* they are implementing the GWR compliance monitoring option. The triggered samples must be incorporated into the water system's coliform sampling plan.

2. Assessment Samples
Assessment sample type refers to ongoing, periodic sampling of the source water that is not triggered by another test result. There are two types of source assessment samples:

- ***Annual* Source Assessment Sample:** The GWR requires at least one "raw" untreated water sample from each source per year from all water systems that disinfect the water in any way - either with oxidizing agents (e.g., chlorine) or ultraviolet light.

- (A triggered source sample can meet this requirement for that calendar year.)
- ***Monthly* Source Assessment Sample:** Groundwater sources that are determined to be at higher risk of fecal contamination are required to collect monthly source samples for twelve months (or only during the months of operation for seasonal systems or sources) to determine whether any fecal contamination exists. Drinking Water Services will notify water systems individually if monthly source assessment monitoring is required.

Where should coliform samples be taken?

Routine coliform samples should be taken in locations representative of the distribution layout of the water system. This means that the samples should be representative of the *entire* water system.

A system's Coliform Sampling Plan shows the general water system layout and identifies locations where routine and repeat samples should be taken.

Depending on the complexity of the water system, such as dead end lines or pipe run where little water is used, this could mean identifying anywhere from one to perhaps eight locations, even in a small system. Samples should be taken at a different location each month to ensure testing is done throughout the system.

Meanwhile, any source samples - triggered, assessment or confirmation - should be collected from the raw water sample tap prior to any treatment or storage.

Should the operator go on vacation, or become unavailable, someone else should be able to read the plan and properly continue the sampling. An outline of information to include in a sampling plan is highlighted in the "Coliform sampling plan template for small public water systems" included in the references section and available from the DWS.

What is a coliform sampling plan?

The coliform sampling plan guides the water operator in selecting routine sampling sites to ensure that sampling and coliform testing is conducted at representative points throughout the system. It takes into account various pressure zones, etc., and in the event of a positive routine test result, establishes repeat sampling sites for monitoring. The plan helps assure proper sampling is conducted even when staff assignments change.

The size and complexity of the plan will be dependent upon the structure and composition of the water system. These plans must be submitted to DWS or your local county health department or Dept. of Agriculture upon request. They must also be made available for review during any site visit or water system survey.

Most small water systems will have relatively simple plans because their structure and composition are not complex.

Water systems with limited distribution systems, such as those supplying schools and single building facilities, are still required to develop a sampling plan.

In most cases, the plan is a relatively short and simple document with a small number of identified sampling sites. The sampling plan is a tool water systems use to identify the most representative points at which to collect microbial samples.

A thorough plan will promote economy in coliform sampling and minimize poor site selection and techniques that contribute to false positive results.

A plan with the following components is recommended:

1. A map of the distribution system showing:

- All water sources and their entry points into the distribution piping;
- The area served by each water source (if not combined prior to distribution);
- Treatment facilities (filtration, disinfection, etc.);

- Storage tanks and reservoirs;
- Pressure reducing stations;
- Booster pump stations;
- Pressure zones;
- Routine sampling sites;
- Repeat sampling sites;
- Source water sampling taps (for triggered, assessment or confirmation sample sites);
- Interconnections and critical valves;
- Pipe material and size (if known);
- Location of blow offs / flushing points.

2. Background information on the system and key contacts including:

- Water system name;
- The seven digit water system ID number (i.e., 41-12345);
- The name of each water source;
- Storage/reservoir volume;
- Treatment plant description--process utilized, source(s) treated, location, etc.;
- Pump stations;
- Total population served;
- Lab contact information including hours and process for bottle pickup and drop off;
- The System regulator – at the local county health department, Dept. of Agriculture, or DWS – to contact for more information.

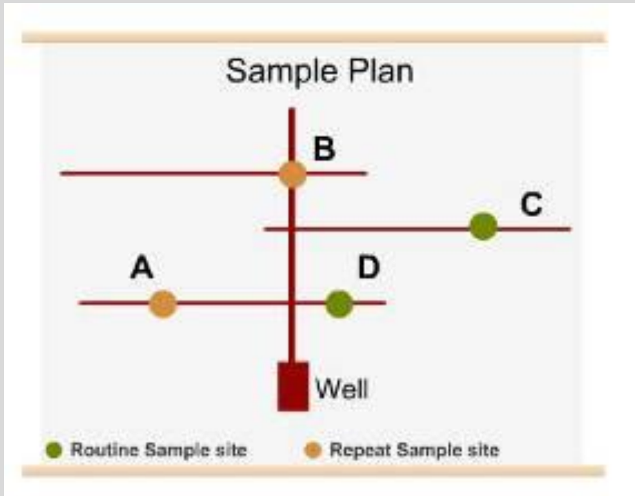
3. A narrative description of the sampling plan including the following information:

- Minimum number of routine samples required per monitoring period;
- The location of all routine sampling sites needed to cover all areas in the distribution system. The location of these sites must be on the map of the system and the specific location (address) must be listed in this section;

- DWS recommends selecting from 3 to 4 times the number of sites needed to meet minimum testing requirements (i.e., if you take 1 sample per month, identify 3 to 4 sites in the system so you can rotate through the system);
- Monthly rotation cycle; typically a system has more sampling sites than required for monthly samples and will rotate among those sites. A description of the rotation schedule must be included. It is desirable to rotate through each sample site from 3 to 4 times per year;
- The location of at least one site upstream and one downstream within five service connections of each routine sample site. These will come into play because systems collecting one sample per monitoring period are required to collect four repeat samples upstream and downstream of the initial site following a positive routine. Systems collecting two or more samples per month must collect three repeat samples for every positive coliform test result;
- Systems collecting fewer than five routine samples per month must collect five routine samples in the month following a coliform detection in a routine sample (even if the repeat samples were all negative). (This requirement will change after April 2016)
- A description of the monitoring required by the groundwater rule; refer to the sampling plan template and guidance.
- A brief narrative on the sample collection technique. Many instances of false positive test results occur due to improper collection technique. An excellent sampling plan is of little value if the personnel collecting samples are not properly trained. Follow the directions the laboratory provides with the sample container. If the system chlorinates, measure and record the free chlorine residual on the lab slip each time a coliform sample is collected;
- A schedule of the distribution line flushing program. This maintenance procedure is vital in reducing the possibility of coliform and biofilm buildup. Systems with dead-end lines should practice distribution line flushing on a regular schedule;
- The name and phone number of the sampling plan preparer;
- The date the plan was prepared.

Selecting routine and repeat sites

The purpose of routine coliform sampling is to assure that the water delivered to all users meets drinking water microbial standards. It is essential that the entire distribution system be routinely monitored since coliform contamination can occur anywhere in the system.



Careful selection of sampling sites is extremely important. They should be located throughout the distribution system, represent varying conditions that occur and be chosen with consideration for the complexity of the water system. It is also important to identify potential areas of concern that may adversely affect the microbiological quality of the water, and include those areas in the sampling plan. Examples of these areas are:

- Cross connection hazards;
- Varying population densities;
- Low pressure zones;
- Deteriorating water mains;
- Low velocity water movement areas;
- Any other areas of concern.

Customers' faucets and specially installed sampling taps are the two most commonly used sampling sites; either is acceptable. Many water suppliers use special taps for coliform sampling sites. These are connected directly to the distribution piping. They can be a simple riser pipe with a faucet connected to the distribution main or a more sophisticated manufactured sampling station that is installed at the water meter or into the distribution main.

Special sampling taps are preferred by some utilities because they are more accessible to the sample collector and are not influenced by conditions within customers' plumbing systems.

Sampling at a customer's faucet may not accurately reflect the conditions of the distribution system due to conditions in the customer's plumbing that are not under the control of the water supplier. However, in many cases, this is the only way to collect a sample. If this is the case, DWS recommends that each faucet be carefully examined to assure suitability. Some examples of undesirable conditions are:

- Swivel-type faucets with a common control valve for hot and cold;
- Faucets with leaky packing material around the stem;
- Faucets that supply areas where bacterial contamination is highly probable, such as janitorial sinks or commercial cleaning sinks;
- Faucets close to or below the ground surface;
- Faucets that point upward;
- Faucets with internal threads in the spout;
- Samples collected through a garden hose or other faucet attachment;
- Faucets with aerators (remove aerators prior to sample collection);
- Drinking fountains and bubblers;
- Yard hydrants.

How *should coliform* samples *be taken?*

Using the proper sampling technique is extremely important in obtaining accurate water quality information. A coliform sample that is collected improperly may indicate contamination of the water supply when, in fact, it is safe. Learning proper sampling techniques will help ensure accurate test results and eliminate the cost of additional unnecessary sampling. If you have any questions about proper sampling procedures, please contact your laboratory, county health department or DWS.

Carefully follow these 3 steps when collecting a coliform sample:

1. **Select a sampling site**
2. **Fill out a laboratory form**
3. **Take the sample and send it in to the lab**

1. Select a sampling site
Select a sampling site where water is commonly taken for consumer use or a dedicated site in the distribution system. These are typically faucets or "hose-bibs." (These sites may already be identified in your sample site plan.)

- Do not take samples outdoors when it is raining or when the wind is blowing excessively. These events can easily contaminate a sample. Once you have selected a sample site, it should be incorporated into your sample site plan.
- The sampling point should be a non-swivel faucet; bacteria can grow in the swivel part. <u>Kitchens often have swivel faucets.</u>
- If it is a faucet with an aerator, remove the aerator, screen and gasket.
- If an outside faucet is used, disconnect any hoses or other attachments. It should be a faucet that does not leak around the packing or valve mechanism. Leaking faucets can promote bacterial growth and leaking water could drip into the sample bottle and contaminate your sample.
- The faucet may initially be sanitized by spraying or immersing in a solution of one (1) ounce of 7.3% bleach per one gallon of water (<u>*do not*</u> use excess bleach as this may falsify results).
- <u>*Do not*</u> use fire hydrants, yard hydrants or drinking fountains as sampling points! They usually have a small hole in the underground pipe to allow for drainage, and this is a great source of coliform bacteria.
- <u>*Never*</u> dip sample bottles in reservoirs, spring boxes or storage tanks in order to collect a sample. First, these are not representative of the distribution system. Second, water running around your hand into the sample bottle will probably test positive.

2. Fill out a laboratory form
Before taking a sample, fill out a laboratory form. It's a good

idea to do this before your hands get wet.
Complete the following information:

- PWS ID number (it begins with 41-)
- Water system name, address, city and phone number
- Collection date and time
- Type of sample: **Distribution** (routine, repeat, special or temporary routines) or **Source** (triggered, assessment or confirmation, refer to previous definitions)
- Name of person collecting sample and sample location
- If your system chlorinates, enter the free chlorine residual. The residual should be measured just prior to the time of sample collection.
- Complete the section for the return address where the report is to be sent.

3. Take the sample and send it in to the lab

- Use only laboratory-provided sample bottles that are specifically for bacteriological sampling. These bottles are sterile and should not be rinsed before sampling. A chemical, usually sodium thiosulfate, is placed in the bottle by the lab and is used for chlorine deactivation. *Do not* rinse the bottle.
- Flush the line thoroughly. *Vigorously run water through the faucet for three to five minutes*. Allow the water to run until there is a noticeable change in the temperature. This colder water is more representative of the quality of water being provided. Use this time to fill out the paperwork and, if your water is chlorinated, also conduct a chlorine residual test.
- *Reduce the water flow to a slow, steady stream* (similar to the diameter of a pencil).
- Don't open the sample bottle until the moment you are going to fill it. Uncap the sample bottle, being careful not to touch the inside of the bottle with your fingers or other objects. Hold the lid opening down, but *never set the lid down* while taking the sample.
- Fill the sample bottle to the fill mark which is usually at the shoulder of the bottle. Leave an air space in the top of the bottle. Do not overfill.
- Replace the cap immediately making sure it is tight and does not leak.

- Package the sample for delivery to the laboratory. Be sure to include the lab form.
- The sample should be kept cool at all times.
- Mail or deliver the sample to the lab immediately. Samples over 30-hours old will not be analyzed by the laboratory. If the sample is too old or leaks in transit, the lab should notify the water system contact to collect another.

What action is needed if a routine sample is positive? When notified by the laboratory of a positive sample, the water supplier must:

- Notify DWS or the County Health Department within 24 hours
- Take repeat samples within 24 hours

Repeat samples are required whenever a routine sample is positive for coliform. There are different follow up requirements based on whether or not the system has treatment (chlorine, UV, or ozone):

A. For systems collecting ONE routine sample either per month or per quarter and <u>DO NOT</u> have treatment:

A total of **FOUR REPEAT** samples are required from the following locations (could be more if the system has multiple active sources at time of positive sample):

- The same tap as the original positive routine sample.
- An active service tap within five active connections *upstream* from where the original positive sample was taken.
- An active service tap within five active connections *downstream* from where the original positive sample was taken.
- A tap at the source(s) (called a triggered source sample) which can be useful for determining a possible origin of contamination. A sample is required from every water source that was active at the time the original positive sample was taken.

B. For systems collecting ONE routine sample per month or per quarter and provide treatment (chlorine, UV, or ozone): FOUR REPEAT samples are required from the distribution **plus a “TRIGGERED”** raw water sample from each source that was active at the time of the original positive sample, as follows:

- The same tap as the original positive routine sample.
- An active service tap within five active connections *upstream* from where the original positive sample was taken.
- An active service tap within five active connections *downstream* from where the original positive sample was taken.
- Another active service tap, anywhere in the distribution.
- A tap at the source(s) (called a triggered source sample) which can be useful for determining a possible origin of contamination. This tap is located as close as possible to the well or spring, prior to the addition of the treatment. *If your system provides 4-log treatment then a triggered source sample is not needed.*

In the month following the initial positive test, the system must take five routine samples, even if all of the initial repeat samples were negative.

Note: It is not an MCL violation unless a repeat test shows the presence of either *total coliform or E. coli (fecal) bacteria.*

Health

State of Oregon - Drinking Water Services
Microbiological Analysis (Coliform) Reporting Form for Public Water Supplies (v3.3)

PWS# 41 ____________
PWS Name: ____________
City, County: ____________
Phone: ________ Fax: ________

Return address for report:
Name: ____________
Address: ____________
City, State, Zip: ____________

ORELAP#:
Lab Name:
Address:
Phone/Fax:
Bottle#: ____________
□ Results do not meet NELAC Standards-See page 2
Lab Sample ID#:

Sample Collected Date/Time: ___/___/___ (MM DD YYYY) ___:___ (Hour : Min) □ AM □ PM
Chlorinated: □No □Yes
Collected By: ____________
Free Chlorine: ________ mg/L

DISTRIBUTION Sample Type: □ Routine □ *Repeat □ Temporary Routine □ Special
*Date of Initial Positive: ___/___/___ (MM / DD / YYYY) *Original Positive ID#: ____________
Address: ____________ Sampled at (ex. "SINK"): ____________

SOURCE Sample Type: □ *Triggered □ *Confirmation □ Assessment □ Special
*Date of Initial Positive: ___/___/___ (MM / DD / YYYY) *Original Positive ID#: ____________
Source ID: SRC-____________ Source name (ex. "WELL #1"): ____________

LAB USE ONLY

Sample Received Date/Time: ___/___/___ (MM / DD / YYYY) ___:___ (Hour: Min) □ AM □ PM
Initials: ________ Temp: ______ °C
Evidence of cooling? □ Yes □ No

Analysis Start Date/Time: ___/___/___ (MM / DD / YYYY) ___:___ (Hour: Min) □ AM □ PM Initials: ________

ORELAP Method(s): Check all that apply.
□ Colilert® □ Colilert-18® □ Colisure® □ Chromocult® □ Coliscan® □ Readycult®
□ SM 9221 B (MTF) + □ E or □ F □ SM 19th Ed. □ SM 20th Ed. □ SM 21st Ed.
□ SM 9221 D (P-A M) + □ E or □ F
□ SM 9222 B (MF) + □ 9221E or □ 9221F or □ 9222G
□ SM 9223 □ ColiTag® □ MI agar □ m-ColiBlue® □ Other: ____________

Test Results:
Total Coliforms: □ Present □ Absent
E. Coli: □ Present □ Absent

Analysis Complete Date/Time: ___/___/___ (MM / DD / YYYY) ___:___ (Hour: Min) □ AM □ PM
Analyst: ____________
Review by: ____________ ___/___/___ (MM / DD / YYYY)

Reported By: ____________ Report Date ___/___/___ (MM / DD / YYYY)

Sample Invalidation:
□ Over 30 hours
□ Leak
□ Heavy non-coliform growth
□ Other ________

OHA USE ONLY

Test results relate only to the parameters tested and to the samples as received by the laboratory. Test results meet all requirements of NELAC unless otherwise noted. This report shall not be reproduced except in full, without written consent of this laboratory. Send results to OHA-DWS P.O. Box 14350, Portland, OR 97293-0350

For technical support and information, please call Data Management Coordinator (ph. 971-673-0405, M-F, 8am-5pm PT) or visit http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/labs.aspx

1

2.2.3 - Inorganic Chemicals (IOCs) Sampling FAQs

Why sample for inorganic chemicals?

Inorganic chemicals (IOCs) are substances usually of mineral origin, but are also by-products of agriculture and industry. They include salts, metals and minerals. Many pose health risks and are primary contaminants.

There are also a number of inorganic chemicals sometimes referred to as secondary contaminants. Monitoring for secondary contaminants is not required as they do not usually pose health risks, but they may affect taste, odor and quality of a system's water or interfere with water treatment.

How often must IOC samples be taken?

All community and non-transient non-community systems must initially conduct IOC tests in each three-year period**.** If your system has a history of three rounds of testing with **no** Maximum Contaminant Level violations, you may apply to DWS for a reduction in testing to every nine-years.

Several inorganic chemicals have different sampling frequencies and procedures, including nitrate, arsenic and lead and copper which are discussed separately below.

What are the health effects?

Nitrate Although nitrate is listed as an IOC, it has different test requirements. ***All public water systems except purchasing systems must test nitrates annually*.** Sensitive populations, including infants less than 12 months old, pregnant women and people with certain blood disorders, are prone to methemoglobinemia (blue-baby disease) when consuming water with high levels of nitrates. Nitrate originates from fertilizers and animal or human waste. It is a concern in areas with intensive agriculture or residential areas with large concentrations of septic systems.

Arsenic Arsenic is odorless and tasteless. It enters drinking water supplies from natural deposits in the earth or from agricultural and industrial practices.

Non-cancer effects can include thickening and discoloration of the skin, stomach pain, nausea, vomiting, diarrhea, numbness in hands and feet, partial paralysis, and blindness. Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate.

The standard for arsenic has been revised to reflect growing awareness of potential health effects at levels previously considered safe. Your system's sampling schedule for arsenic may change depending on sampling history and any levels of arsenic detected. Check with DWS or your county health department representative for your individual system's sampling requirements.

Lead and Copper Both lead and copper have serious health effects and come from similar sources in a system. Lead is particularly harmful to a fetus and small children where it interferes with proper nervous system development. It may also cause premature birth, reduced birth rate, seizures, behavioral disorders, brain damage and lowered IQ in children. Long-term exposure to lead (in excess of the drinking water standard) has been linked to cancer, stroke and high blood pressure in adults. Copper also has serious health effects and may cause severe stomach cramps and intestinal illness.

Lead and copper in the drinking water system usually originate from plumbing system corrosion. Where the water supply is corrosive, homes with copper or galvanized pipes, lead solder joints and brass plumbing fixtures are at risk of increased concentrations of lead and copper. Signs of corrosion include metallic taste, bluish green stains in sinks and bathtubs, and in severe cases, small leaks in plumbing systems.

***Lead and Copper Sampling* Requirements**

Lead and copper have special sampling requirements (OAR 333-061-0036) that are different from most inorganic chemicals. Initial testing establishes further lead and copper testing requirements for each water system. Community and non-transient, non-community water systems should have completed initial testing, which involves collecting two rounds of samples in consecutive six-month periods of a calendar year. The number of samples collected in the initial testing period depends on the size of the system:

- Systems with a population of <100 are required to take 5 samples.
- Systems with a population of 101 to 500 must take 10 samples.
- Systems with a population of 501 to 3300 must take 20 samples.

Sampling requirements may be reduced if the results of the initial testing did not exceed the 90th percentile of the action level for either lead or copper. The frequency may be reduced to annual or every 3 years, depending on the results of the initial rounds. The number of samples for systems serving between 101 to 3300 people may be reduced by half. There is no reduction for systems taking only five samples.

High risk contamination sites include single family structures or any building containing copper pipes with lead solder constructed between Jan 1, 1983 to June 30, 1985, or that may have had any type of lead piping.

What is the lead and copper sampling procedure?

1. Request sample kits from the laboratory. Read the instructions.
2. Test samples are taken from inside homes or buildings, and must be taken as a "first draw." This means the water in the facility must sit in the pipes for a minimum of six hours and no longer than 18 hours. Most operators instruct their customers how to take a sample and have them place the sample by the front door. If everyone in the house has gone to work or school, another option is to have the sample taken in the afternoon when the first person returns home.
3. The person who collects the sample should fill out a simple chain of custody.
4. The sample must be collected from a kitchen or bathroom ***cold water*** faucet. Water should ***not*** be run prior to sampling; this is called a "first draw" sample. Place the open sample bottle below the faucet, gently open the cold water tap and fill a one-liter bottle.
5. Fill out the lab slip paperwork, place it in the sample kit and return it to the lab.

2.2.4 - Organic Chemicals (VOCs & SOCs) Sampling FAQs

Why sample for organic chemicals?

Organic chemicals are a group of more than 100 mostly man-made chemicals. They can occur in drinking water sources due to industrial activity, landfills, gas stations or pesticide use. Many organic chemicals are carcinogenic (cancer causing), so they often have very low drinking water standards, usually measured in µg/L or ppb (micrograms per liter which is the same as parts per billion).

Generally, organic chemicals are grouped into two major categories:

- **Volatile Organic Chemicals (VOCs).** VOCs are man-made compounds that, at normal temperatures, readily vaporize from water into the air. They present a health risk not only from drinking contaminated water, but also from inhaling VOCs that escape from the water during showers or other home uses. VOCs also may be absorbed directly through the skin during bathing and showering.

They are commonly used as solvents, fuels, paints or degreasers. Virtually all VOCs produce an odor in water, although it may not be obvious before the drinking water standard is exceeded. Nearly all VOCs have primary drinking water standards (MCLs), because they cause cancer or damage to the liver, kidneys, nervous system or circulatory system. Numerous VOCs are regulated in public water supplies.

- **Synthetic Organic Chemicals (SOCs).** SOCs are manufactured, carbon-based compounds that are typically found in pesticides, herbicides and fungicides. Others are used in the making of plastics. Nearly all SOCs commonly found in water are pesticides, with a few notable exceptions (such as PCBs and dioxin). They differ from VOCs because they do not readily escape into the air from water.

What are the sampling requirements for VOCs and SOCs?

Each test must be performed during each three-year period, unless a waiver has been obtained from the DWS. State certified laboratories have the list of chemicals required for these tests.

How is organic chemical sampling conducted?

How an organic sample is taken depends upon whether it’s a VOC or an SOC test.

Generally, laboratories supply test kits that contain a small cooler, freeze packs, sample bottles and instructions. The lab will sometimes provide a “blank” sample with your kit. Do not do anything with this sample. A blank sample simply assures that sample bottles were not exposed to open sources of chemicals that may affect final results.

The following is a general set of instructions, but again, read your lab instructions carefully.

1. ***DO NOT*** take samples near any open sources of chemicals, such as gas cans, pesticides, weed-killers, etc. Taking a VOC sample near a running engine of any kind, such as a vehicle or lawn mower, can easily produce incorrect results.
2. Freeze the cold pack before sampling.
3. **Carefully read the instructions!** Some tests require bottles to be filled completely, and others require it be filled only to the shoulder. Some vials cannot contain air bubbles. Take care to follow safety instructions. Usually, the VOC sampling vials contain a few drops of acid to stabilize the sample. The acid can cause burns, so beware!
4. Locate a sampling point that is representative of your source-water ***after*** treatment but prior to entry to the distribution system.
5. Remove any attachments from the tap such as hoses, filters, screens or aerators.
6. Flush the water for about 10 minutes or until a constant temperature is reached. Use this waiting time **to fill out the chain of custody.**
7. Reduce the water flow to a small even flow (about the diameter of a pencil) and fill the sample container as instructed. ***Do not*** wash out any existing contents in the sample container.
8. Pack the samples with the freeze pack and return them to the laboratory as soon as possible.

2.2.5 - Radionuclides

Why test for radioactivity?
Radioactivity usually occurs in water from radium, uranium or radon. These naturally-occurring materials emit radioactivity as alpha, beta or gamma radiation. Each form of radiation affects the human body differently, yet all can lead to cancer.
Radioactivity in water is normally measured in picocuries per liter (pCi/L) or in millirem, which is a measurement of the dosage of radiation to the human body.
In the small number of drinking water systems with radioactive contaminant levels high enough to be of concern, most of the radioactivity is naturally occurring — although some systems are located in areas where man-made radioactive

contamination may occur. Manmade radioactive contamination sources include facilities that use, manufacture or dispose of radioactive substances. Drinking water contamination may occur through accidental releases of radioactivity or through improper disposal practices. Water systems that are vulnerable to this type of contamination are required to perform extensive monitoring for radioactive contamination to ensure that their drinking water is safe.

What is the sampling requirement for radionuclides?
All community water systems must test for radionuclides. Specific rules are found in OAR 333-61-0036. Additionally, if DWS determines the water supply is vulnerable to radiation contamination or is actually contaminated, increased monitoring will be required.

Initial Monitoring
Community water systems gross alpha particle activity, radium 226, radium 228 and uranium must conduct initial monitoring to determine compliance with OAR 333-061-0030(5).

Samples must be collected from each entry point to the distribution system during four consecutive quarters. DWS may waive the final two quarters of the initial monitoring at an entry point if the results of the samples from the first two quarters are below the method detection limit.

Reduced Monitoring
Radionuclide monitoring may be reduced to once every three years, once every six years or once every nine years based on initial sampling results. Contact DWS or your local county health department for more information.

How do I sample for radionuclides?

1. Contact a laboratory that conducts radionuclide (often referred to as “Rad”) testing and notify them of the appropriate test needed.
2. Read the instructions carefully. Fill each sample container as directed. The sample location is at the source after treatment but prior to entry to the distribution system.
3. Fill out the sample paperwork and take the sample. Samples do not need to be cooled, but they should be sent to the laboratory as soon as possible.

2.2.6 - Disinfection By-Products (DBPs)

Why sample for Disinfection By-Products (DBPs)?

Many water systems add chlorine or other chemical disinfectants for treatment to destroy or inactivate microbial organisms. However, these disinfectants may form **disinfection by-products (DBPs)** when they react with naturally occurring organic substances in the water.

Long term exposure to DBPs has been linked to bladder cancer, and possibly colon and rectal cancers. More recent studies have shown that shorter-term exposure to high levels of DBPs may be associated with adverse reproductive and developmental health effects. Regulated DBPs include Total trihalomethanes (TTHMs) and haloacetic acids (HAA5s).

What is the DBP sampling requirement?

In 2006, US EPA finalized the “Stage 2 Disinfection By-Products Rule.” This rule builds on previous DBP rules (TTHM rule, Stage 1 DBP rule) by providing more consistent protection from DBPs across the entire distribution system. The rule is applicable to all community and non-transient, non-community (NTNC) water systems that deliver water that has been disinfected with anything other than ultraviolet (UV) light. This includes systems that purchase disinfected water. **The rule applies regardless of the reason why the disinfectant is used.**

All systems subject to the rule must develop a **Compliance Monitoring Plan** that identifies how they intend to sample for compliance with the Stage 2 DBP rule.

Monitoring is based on source water type and the population served by the system. Groundwater systems serving populations of less than 500 must sample annually at the location with the highest TTHM or HAA5 concentrations (note: this may be the same location).

Based on those results, monitoring may be reduced to one TTHM and one HAA5 sample every 3 years for these systems. <u>Monitoring must occur during the month of highest historic DBP concentrations in the system.</u>

2.2.7 - Regulatory Changes

At this time, there are new rules being promulgated. The rule expected to have the most impact on small systems is the Revised Total Coliform Rule (RTCR). This rule will change the actions required of water systems following the confirmation of total coliform in the distribution. The presence of total coliform will no longer be a MCL violation. The RTCR may also change the number of repeat coliform samples required for water systems.

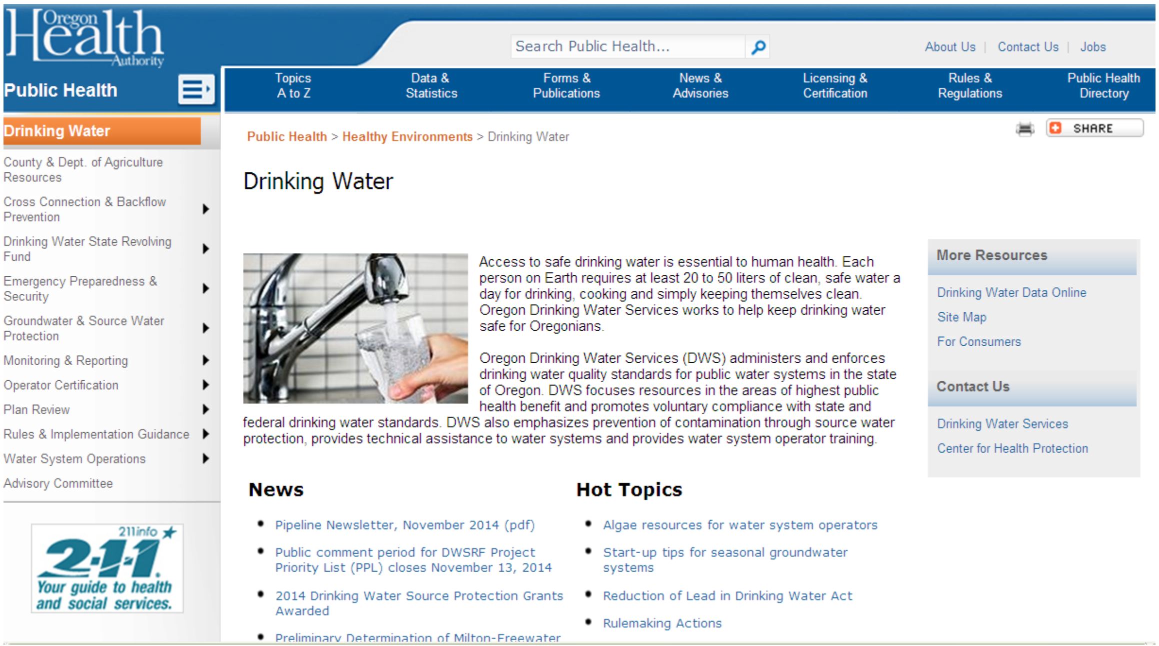
US EPA is always conducting research and may develop new monitoring requirements.

It's a good idea to periodically review the DWS website, http://healthoregon.org/dwp, or speak with a DWS, Dept. of Agriculture or county health representative to ensure you have the most current information.

2.2.8 Using the OHA Drinking Water Services Website

The OHA-DWS homepage at http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Pages/index.aspx contains a wealth of information. You may always contact DWS or your county health department for assistance as well.

DWS homepage:



The following locations may help you with sampling and reporting requirements.

Determining Sampling Requirements and Past Results

Once on the main website, use *Data Online* to review chemical testing requirements and results for your system. Follow these procedures:

1. Go to the website, and click the “Data Online” heading (on the right hand side). This will take you to the DWS database of all public water systems in Oregon.
2. At the top of the next window, you will see numerous category options in blue at the top. Click on “WS Name Look Up.”
3. Type in the name of your water system. A list of systems with any matching names will come up on the screen. At the left you’ll see system ID numbers underlined and in blue. Click on the blue number corresponding to your water system.
4. Scroll down to the bottom of the page. Click on “Chemical Schedule Details” in the middle of the blue

categories. This link will take you to a page listing the chemical sampling requirements for your system. For each chemical type, it gives the required sampling interval, the end of the current monitoring period (that is, the date by which samples are due), and the date of the last known results.

At the bottom of each *Data Online* page, you may also click on other blue categories to find your system's latest chemical results, coliform sampling schedule, coliform results and more.

Finding DWS Monitoring Forms

From the main website, click on "Monitoring and Reporting", then "Monitoring and Reporting Forms", where the available information includes:

- Water System Sampling Points;
- Coliform monitoring;
- Turbidity and Surface Water Treatment;
- Groundwater Rule;
- Chemical Monitoring; and
- Lead and Copper Corrosion Control.

To obtain a general summary of your chemical sampling requirements, click on "Chemical Monitoring" at the top of the page. Then click on "Community and Non-Transient Water Systems" or "Transient/ Non-Community and State Regulated Water Systems" to match your system type.

To review all regulations for drinking water in Oregon, go to: http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Rules/Pages/index.aspx

UNIT 2: Sampling and Reporting

FACT SHEET 2.3 - Public Notice Requirements

2.3.1 - Public Notice FAQs

2.3.2 - Available Templates

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 2.3 - Public Notice Requirements

2.3.1 – Public Notice FAQs

What is public notice?
Federal and state regulations require all public water systems to provide notice to their consumers any time there is a violation of drinking water standards. Public notice of drinking water violations provides consumers with a means whereby they will always know if there is a problem with their drinking water and, when appropriate, with the information needed to avoid or minimize any associated risk.

Public notification regulations were established under the 1974 Safe Drinking Water Act (SDWA). The SDWA has been amended twice since 1974, with Congress reaffirming its position that public notice is an important responsibility for public water systems. Rules governing public notification are outlined in the Oregon Administrative Rules (OAR), Chapter 333-061-0042 which defines the form, manner, content and frequency of public notices.

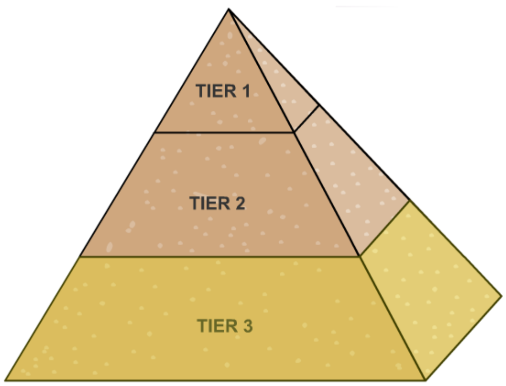
Specific language must be used in public notification. It is important that OHA templates are used. Go to the website here: ***http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Operations/Pages/publicnotices.aspx#templates*** for information.

Who must give public notice?
It is the ***responsibility*** of the owner or operator of a public water system to give public notice for all violations of drinking water standards.

Who must be notified?
When required, public notice must be given to ***all persons served by the water system*.** Public water systems that sell or otherwise provide drinking water to other public water systems (i.e., to consecutive systems) are required to give public notice to the owner or operator of the consecutive system. The consecutive system is responsible for providing public notice to the people it serves.

Some public water systems may have a portion of the distribution system that is physically or hydraulically isolated from other parts of the distribution system. If this is the case, DWS may allow the system to limit distribution of the public notice to only persons served by that portion of the system which is out of compliance. Permission by DWS for limiting distribution of the notice must be granted in writing. A copy of the notice must also be sent to DWS when it is sent to the customers.

What are the three tiers of violations?



Public notice requirements are divided into **three tiers**, designed to take into account the seriousness of the violation or situation and any potential adverse health effects that may be involved. The specific public notice requirements for each violation or situation are determined by the tier to which it is assigned. Tiers are defined as follows:

Tier 1: Critical/Urgent (Immediate notice required) Public notice is required within 24 hours for violations of the National Primary Drinking Water Regulations and for situations with significant potential to have serious adverse effects on human health as a result of short-term exposure. (**Table 2.3.1 (a)** lists the violation categories and other situations requiring a Tier 1 public notice.)

Tier 2: Important (Notice as soon as possible within 30 days) Public notice required for other situations with potential to have serious adverse effects on human health. (**Table 2.3.1 (b)** lists the violations and situations requiring a Tier 2 notice).

Tier 3: No immediate concern (Remaining violations) Public notice required for all other violations and situations not included in Tier 1 and Tier 2.

Public notice must:

- Include appropriate mandatory language,
- Adhere to deadlines and delivery method for distribution (based on the type and tier of violation), and
- Include a description of the violation and any potential health hazard.

More specifically, public notice must address these elements:

- Description of the violation or situation
- When the violation or situation occurred

- Potential health effects
- The population at risk
- Whether alternate water supplies should be used
- Actions consumers should take
- What is being done to correct the violation/situation
- When the system expects to return to compliance
- Name, number and business address for more information
- Standard distribution language
- Monitoring failure language (if monitoring violation)

Requirements on public notice, including timing and method of notification, vary for each tier of violation.

Tier 1 Violation

When is a Tier 1 public notice required? What additional steps are required?

Table 2.3.1 (a) lists the violation categories and other situations requiring a Tier 1 public notice.

Table 2.3.1 (a)

Violation Categories and Other Situations Requiring a Tier 1 Public Notice

- Confirmed presence of fecal coliform (*E. coli)* in the water distribution system.
- Violation of the MCL for nitrate, nitrite, or total nitrate and nitrite.
- Occurrence of a waterborne disease outbreak, or other waterborne emergency (such as a significant interruption in key water treatment processes, a natural disaster that disrupts the water supply or distribution system, zero pressure in distribution lines, or a chemical spill or unexpected loading of possible pathogens into the source water) which significantly increases the potential for drinking water contamination.
- Detection of *E. coli* in source water samples as specified in OAR 333-061-0036(6)(r) and OAR 333-061-0036(6)(w); and
- Other violations or situations with significant potential to have serious adverse effects on human health as a result of short-term exposure, as determined by the DWS in its regulations or on a case-by-case basis.

Public water systems must:

- Provide a public notice as soon as practical, but no later than 24 hours after the system learns of the violation;
- Initiate consultation with DWS as soon as practical, but no later than 24 hours after the public water system learns of the violation or situation, to determine additional public notice requirements; and
- Comply with any additional public notification requirements that are established as a result of the consultation with DWS. Such requirements may include the timing, form, manner, frequency and content of repeat notices (if any) and other actions designed to reach all persons served.

Tier 1 public notice delivery: Public water systems must provide the notice within 24 hours in a form and manner reasonably calculated to reach all persons served. This includes residential, transient and non-transient users of the water system.

The notice must include mandatory language describing the health hazard. In order to reach all persons served, water systems are to use, at a minimum, one or more of the following forms of delivery:

- Appropriate broadcast media (such as radio and television);
- Posting of the notice in conspicuous locations throughout the area served by the water system;
- Hand delivery of the notice to persons served by the water system; or
- Another delivery method approved in writing by DWS.

Tier 2 Violation
When is a Tier 2 public notice to be provided?

Tier 2 violations are outlined in **OAR 333-061-0042** and summarized in **Table 2.3.1 (b)**. Public water systems must provide the public notice as soon as practical, but no later than 30 days after the system learns of the violation.

If the public notice is posted, the notice must remain in place for as long as the violation or situation persists, but in no case for less than seven days, even if the violation or situation is resolved.

Table 2.3.1 (b)
Violations and Situations Requiring a Tier 2 Public Notice

- All violations of the MCL and treatment technique requirements, except where a Tier 1 notice is required or where DWS determines that a Tier 1 notice is required;
- Violations of the monitoring and testing procedure requirements where the Authority determines that a Tier 2 rather than a Tier 3 public notice is required, taking into account potential health impacts and persistence of the violation;
- Failure to comply with the terms and conditions of any variance or permit in place;
- Failure to respond to deadlines outlined in water system survey reports prepared by DWS as required in OAR 333-061-0076 and 222-061-0077;
- When an emergency groundwater source is used and is potentially under surface water influence but has not been fully evaluated; and
- All violations of groundwater treatment technique requirements as specified in OAR 333-061-0032(6)(g) through (6)(i).

DWS may, in appropriate circumstances, allow additional time for the initial notice of up to three months from the date the system learns of the violation. DWS must grant the extensions in writing. The public water system must repeat the notice every three months as long as the violation or situation persists, unless DWS approves a different frequency in writing.

Tier 2 public notice delivery: Public water systems must provide the initial public notice and any repeat notices in a form and manner reasonably calculated to reach persons served in the required time period. There is mandatory language describing the health hazard that must be included. The form and manner of the public notice may vary based on the specific situation and type of water system, but it must at a minimum meet the following requirements. Unless directed otherwise by DWS in writing, **community water systems** must provide notice by:

- Mail or other direct delivery to each customer receiving a bill and to other service connections to which water is delivered by the public water system; and
- Any other method reasonably calculated to reach other persons regularly served by the system, if they would not normally be reached by the notice in the paragraph above. Such persons may include those who do not pay water bills or do not have service connection addresses (e.g., house renters, apartment dwellers, university students, nursing home patients, prison inmates, etc.). Other methods may include:
    - ♦ Publication in a local newspaper; delivery of multiple copies for distribution by customers that provide their drinking water to others (e.g., apartment building owners or large private employers);
    - ♦ Posting in public places served by the system or on the Internet; or
    - ♦ Delivery to community organizations.

Unless directed otherwise by DWS in writing, **non-community water systems** must provide notice by:

- Posting the notice in conspicuous locations throughout the distribution system frequented by persons served by the system, or by mail or direct delivery to each customer and service connection (where known); and
- Any other method reasonably calculated to reach other persons served by the system if they would not normally be reached by the notice in the paragraph above. Such persons may include those who may not see a posted notice because it is not in a location they routinely pass by.

    Other methods may include: publication in a local newspaper or newsletter distributed to customers; use of e-mail to notify customers, employees or students; or delivery of multiple copies in central locations (e.g., community centers).

Tier 3 Violation

Tier 3 public notice delivery: Tier 3 violations are defined as violations other than Tier 1 or 2. Specifics are outlined in OAR 333-061-0042. Public notice must be issued within one year of the violation or situation. Following the initial notice, the system must repeat the notice annually for as long as the violation or other situation persists. If the public notice is posted, the notice must remain in place for at least 7 days even if the a pH of less than 8.4. violation or situation is resolved.

The method of delivery for community and non-community systems is the same as outlined for Tier 2 violations. Instead of individual Tier 3 public notices, a community public water system may use its annual Consumer Confidence Report (CCR) for Tier 3 notices detailing all violations and situations that occurred during the previous twelve months.

2.3.2 - Available Templates

The DWS website includes links to templates for public notification for specific types of violations. You may also contact your water system regulator for templates. Templates at this website include information on required methods of delivery, common corrective actions, and sample language: http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Operations/Pages/publicnotices.aspx

Specific language must be used in public notification. It is important that these templates are used.

UNIT 2: Sampling and Reporting

FACT SHEET 2.4 - Consumer Confidence Report

2.4.1 - Consumer Confidence Report FAQs

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 2.4 - Consumer Confidence Report (Community Water Systems Only)

2.4.1 - Consumer Confidence Report FAQs

What is a Consumer Confidence Report (CCR)?
Every year, all community water systems must provide their customers with a CCR. The CCR summarizes basic information about the source, operation and water quality of the system using information that your water system already collects to comply with regulations, along with some educational information that may be important to consumers. The intent of the report is to inform the consumer about their drinking water so that they can make informed health decisions for their families and themselves. It also provides an opportunity for operators to educate their users on what it takes to keep a system operating.

The reports are due to customers (with a copy to DWS) by July 1st following the year covered in the report). A certificate that specifies when and how the CCR was distributed is due to the DWS no later than October 1.

Who gets the CCR?
The water supplier must make a “good faith” effort to send the report to all consumers who use water (both paying and non-paying, such as apartment dwellers). Reports may be included with water bills, sent as separate mailers, or directly delivered to each customer.

What is included in the report?
While there is a lot of flexibility in how the report is constructed, there are some specific language and content requirements for the general report, as well as specific language for contaminants detected in your drinking water.

CCR required content includes:

- General information on the administration of your water system including opportunities for public involvement and water system contact information;
- The source of the water served (such as groundwater, surface water, water from another system), and the name and location of its source;
- If a source water assessment has been completed, notification of the information available, and a summary of the report;

- A table showing any regulated or unregulated contaminant or disinfection by-product that has been detected;
- Specific definitions [e.g., Maximum Contaminant Level (MCL), to provide consumers with a means of interpreting the table of detections. (See OAR 333-061-0043);
- If an MCL is violated, specific health effect language. This is available in the templates or OAR 333-061-0043;
- If the detection limit is exceeded, possible origins of the contaminant (see templates);
- Any treatment monitoring, reporting or record keeping violations;
- Any variances or exemptions that the system may be operating under;
- Specific language addressing vulnerable populations, available in OAR 333-061-0043 and/or the templates;
- Specific phone numbers for federal and state contacts.

The regulation also requires certain educational language and a specific table format for summarizing detected contaminants. Mandatory language for detected contaminants may be found in EPA's "Public Notification Handbook" which has a link on the DWS website under "Public Notice Resources and Templates". Utilities may include additional information to better acquaint customers with their particular operations.

When must the plan be distributed and certified?

The CCR must be delivered to all customers of the water system and to the DWS by July 1 of each year. DWS must also receive by October 1 of the same year a certification as to how and when the CCR was distributed. It is usually easier to submit both the CCR and the certification form at the same time as it's delivered to the community. A copy of the certification form may be downloaded from the DWS website http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Monitoring/Pages/ccr.aspx.

What should the report look like?

A report that contains too much information or is full of technical jargon can discourage consumers from learning about their drinking water. You don't need a fancy computer or a graphic designer to produce a CCR that is easy to read and inviting to your customers.

A few things to consider: Write short sentences. Keep your paragraphs short, too. Don't make your text size too small. You might want to squeeze a few extra sentences into your report, but if you add too much, people might ignore the entire report. Be as simple and straightforward as possible and avoid acronyms, initials and jargon.

As discussed previously, there is required content for the general report, and specific language for contaminants detected in your drinking water.

The DWS website has useful templates. Review these templates before you begin preparing your CCR – you'll find they save you a lot of time and effort.

The Tools and Resources section has links to several useful templates as well as a checklist of items to include in the CCR.

There is also a resource you may use to develop your CCR online. Go to this link for the Consumer Confidence Report iWriter: http://www.ccriwriter.com/.

UNIT 3: Operations

FACT SHEET 3.1 - Overview of Disinfection and Other Water Treatment Methods

3.1.1 - Chlorine

3.1.2 - Ultraviolet Light

3.1.3 - Ozone

3.1.4 - Iron and Manganese Removal

3.1.5 - Corrosion Control

3.1.6 - Nitrate Removal

3.1.7 - Arsenic Removal

3.1.8 - Filtration

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.1 - Overview of Disinfection and Other Water Treatment Methods

System treatment requirements differ depending on whether the system uses ground water or surface water. When choosing a treatment option, there are several factors to consider including:

- Regulations
- Characteristics of the raw water
- Cost
- Operating requirements
- Configuration of existing system
- Future needs.

Remember, treatment for health protection is the primary consideration: aesthetics are secondary.

A brief overview of disinfection (the process of killing microorganisms in water that might cause disease or pathogens) and other water treatment methods follows.

Chlorine disinfection

3.1.1 - Chlorine

In the United States, chlorine was first used as a drinking water disinfectant in 1908 in Jersey City, New Jersey. It proved so successful that many other cities followed suit, and cases of typhoid and other waterborne diseases dropped dramatically throughout the country.

Successful prevention of waterborne disease and its relatively low cost have made chlorine one of the most widely used drinking water disinfectants in the world. Chlorine is also used as an oxidizing agent for iron, manganese and hydrogen sulfide and for controlling taste and odor problems. Its effectiveness as a disinfectant depends on factors such as pH, temperature, free chlorine residual, contact time (time in contact with the water) and the presence of interfering agents.

When combined with some organic matter, chlorine can form disinfection byproducts (DBPs) that can cause cancer in humans. If you are using chlorine, testing and controlling for DBPs is an important part of running a safe water system.

In all cases, chemicals injected into potable water systems must have an appropriate industry certification for this use.

The National Sanitation Foundation (NSF) is one of the larger certification agencies and an “NSF” logo is commonly found on labels of approved products containing chlorine.

How does chlorine work?
Chlorine combines with water to produce the two primary disinfectant forms called hypochlorous acid (HOCl) or the hypochlorite ion OCl^-.

The predominance of either generally depends upon the water’s pH. Hypochlorous acid is more potent and predominates at pH levels below 7.3. The ion form occurs more readily at higher pH levels.

Both HOCL and OCl^- are collectively measured using the “free” chlorine test. Free chlorine has a high affinity for certain chemicals and microorganisms.

The actual reaction these forms of chlorine have with microbial contaminants is still not known. Chlorine appears to breach the cell wall and either kill microorganisms very quickly or destroy the ability of the organism to reproduce, thus inactivating it.

Chlorine demand and chlorine residual

Upon being added to water, available chlorine combines with organic materials, chemicals or bacteria. As a result the amount of available chlorine is reduced.

This immediate reduction in chlorine is called **"demand."** Dosages must be calculated to take into account this phenomenon so that **residuals**, or available/un-used chlorine, are maintained throughout the distribution system. When testing for chlorine residuals, the "free" test measures chlorine in water that is still available for disinfection. The "total" test measures the sum of both free and combined chlorine.

Simply stated:

Dose = Demand + Residual

Dose is what is applied to the water.

Demand is the amount of chlorine that is absorbed by various chemicals and organic matter in the water.

Residual is what is left over (available) to disinfect water in the distribution system. It is extremely important to have residuals throughout the distribution system.

Forms and Application of Chlorine

Chlorine is a chemical element that has three different forms: solid (powder or tablets), liquid (bleach) and gas. Chlorine can also be combined with ammonia to form chloramine which is also used to disinfect drinking water. Features of chlorine's various forms are described below.

- **Solid or Dry Chlorine**: *Calcium hypochlorite is* the solid form of chlorine. Usually found in tablet or powder form, it generally contains 65% chlorine by weight. It is white or yellowish-white granular material and is fairly soluble in water. It is important to keep calcium hypochlorite safely stored in a dry, cool place. If not stored properly, chlorine's shelf-life can be severely shortened. Dry chlorine can also ignite if mixed with certain organic chemicals, such as gasoline. When mixing, always add calcium hypochlorite to the correct volume of water. There are different types of feeding systems for delivery of calcium hypochlorite, but the most common is dilution in water to create a solution of desired strength based on water demand and needed residual. Once the solution is created, a small chemical feed pump is used to inject it into the water system. The advantages of using dry chlorine are cost and ease of use. The disadvantages are that it produces an inconsistent chlorine residual, and it can react violently with petroleum products and some organic materials.

- **Liquid Chlorine**: Sodium hypochlorite (NaOCl) is the liquid form of chlorine. It is clear with a slight yellow color. Ordinary bleach is one of the most commonly used forms of sodium hypochlorite. Chlorine strength is typically available at 8.25%, 12.5% or 15% by volume. Sodium hypochlorite can lose up to 4% of its available chlorine content per month and therefore should not be stored for more than 60 to 90 days.

  Caution should be used when using liquid chlorine. It is very corrosive, can cause blistering of the skin and will ruin clothing. It should be mixed and stored away from equipment.

  Liquid chlorine can be purchased by gallon containers or in 55 gallon drums. Most small systems use gallon containers, because of the decline in chlorine content over time.

  The gallon containers are mixed into a larger container of water to create a solution of a desired strength. The desired strength (dose) will be determined by the water demand and the desired residual. The solution is fed into the water with a small pump.

  The advantage of using liquid chlorine is its low cost and ease of use. The disadvantages are loss of potency when not used promptly and some safety issues. However, this is still the most commonly used product for chlorination.

- **Gaseous chlorine** is produced from liquid chlorine placed under pressure in a metal vessel. The vapors rising from the top of the liquid are drawn from the vessel to disinfect water. Chlorine gas is very dangerous and may be fatal when directly inhaled. Unless water system personnel are properly trained to work with these containers, chlorine gas should not be used.

Smaller systems will likely find the initial cost of installation, the required safety equipment and operator training prohibitive. But if used, small systems typically obtain chlorine gas in 150 pound cylinders which should be secured to prevent them from falling over and causing a leak.

In order to draw the chlorine gas from the cylinder, a system comprised of a regulator, rotometer and injector is needed. Typically, the injector has a water supply flowing through an area that is throated, which provides vacuum. The vacuum opens the regulator and allows gas to flow to the injector and into the water being treated. The rotometer allows an operator to control the amount of chlorine gas injected into the drinking water.

Gaseous chlorine cylinders

- **Chloramines** include Monochloramine, Dichloramine, and Tetrachloramine; These are compounds produced by a reaction between chlorine and ammonia. Chloramination is the process of adding chlorine and ammonia to water for disinfection. Chloramine compounds have far less disinfectant potential than free chlorine, but nonetheless continue to attack microorganisms.

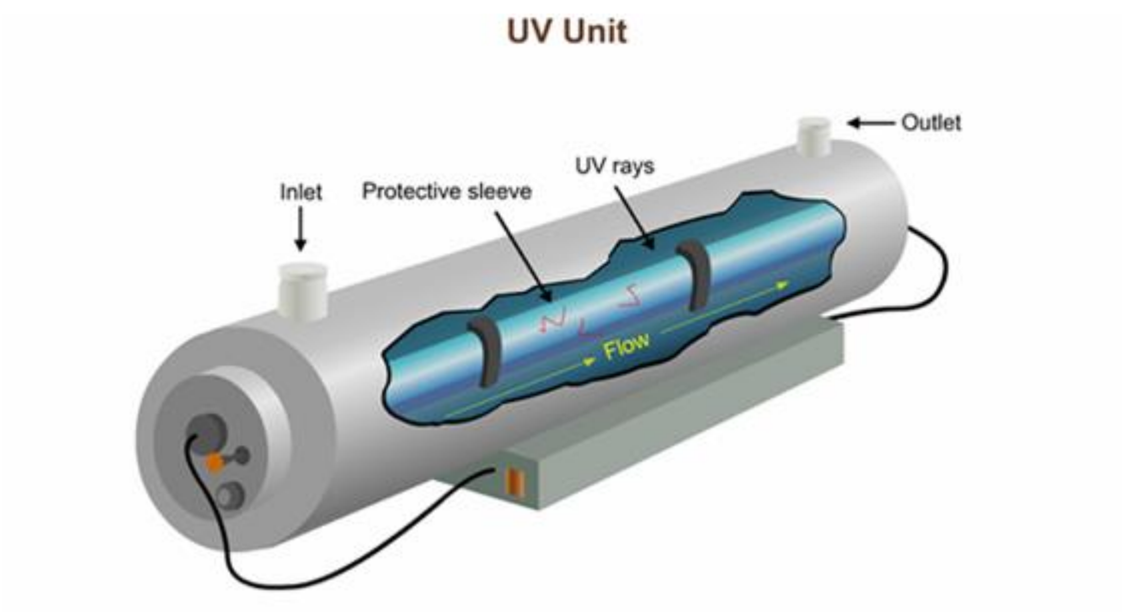
  Chloramines have two advantages over regular chlorination. They produce chlorine residuals that do not dissipate or "fade away" as quickly and are sometimes used to maintain disinfection residuals in long distribution systems. Depending on the application, chloramination also may produce fewer byproducts.

3.1.2 - Ultraviolet Light

Ultraviolet (UV) light produced from UV lamps is an effective bactericide for both air and water. Disinfection occurs through radiation of microorganisms by UV light rays. The rays must come into contact with each microorganism in order to be effective. The quantity of radiation required depends on such factors as turbidity, color and dissolved iron salts, all of which prevent penetration of ultraviolet energy through water. For this reason, UV light is not satisfactory for disinfecting water with high turbidity.

Cylindrical UV disinfection units with standard plumbing fittings have been designed for in-line installation in water lines. The intensity of the light should be checked frequently and the sleeve around the bulb periodically cleaned. Some units have an externally operated plunger-type apparatus for this purpose.

One disadvantage of UV light is that no residual remains in the water to continue disinfecting throughout the distribution system. Thus, there is no barrier to prevent recontamination. Another disadvantage of UV light is that its use requires a continual source of electrical power.

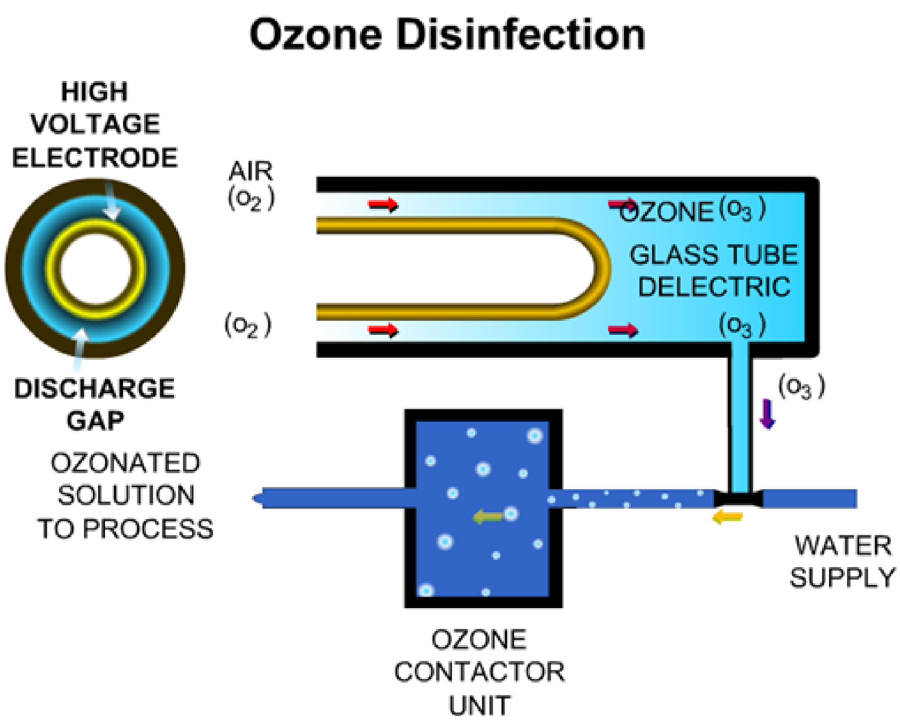


3.1.3 – Ozone

Ozone is a strong disinfecting agent and is also used to control taste and odor. While ozone is widely used for disinfection and oxidation in other parts of the world, its use is relatively new and limited in the United States.

Ozone is unstable at ambient temperatures and pressures and therefore must be generated on site and used quickly. Ozone is generated by applying a high-energy electrical field to either pure oxygen or dried air. Disinfection takes place as ozone gas is added to flowing water. The half-life of ozone in water is fairly short, generally minutes, due to its regression back to oxygen.

For this reason, a secondary disinfectant may be required so that a disinfectant residual is maintained and measured throughout the distribution system. Ozone does not form disinfectant byproducts (DBP) such as trihalomethanes (THMs), but, if there is bromide in the water source, it can create the DBP, bromate. Ozone's main disadvantages are its high cost and the complexity inherent in onsite generation.



3.1.4 - Iron and Manganese Removal

Many groundwater systems have iron and manganese problems. Neither iron nor manganese in water presents a health hazard. However, their presence in water may cause problems with taste, coloration and staining of clothes or fixtures.

Iron causes reddish-brown staining of laundry, porcelain, dishes, utensils and even glassware. Manganese acts in a similar way, but causes a brownish-black stain. Soaps and detergents do not remove these stains, and the use of chlorine bleach and alkaline builders (such as sodium carbonate) can actually intensify them. Iron and manganese deposits will also build up in pipelines, pressure tanks, water heaters and water softeners, reducing the available quantity and pressure of the water supply.

Iron and manganese accumulations become an economic problem when water supply or softening equipment must be replaced. Also, pumping water through constricted pipes, or heating water with heating rods coated with iron or manganese minerals, increases energy costs.

In a water source, iron and manganese can be independent of each other or exist together. They are concentrated in water by contact with rocks, minerals, and occasionally, fabricated materials such as iron and steel pipes. High levels of iron and manganese occur more commonly in ground water supplies than surface water.

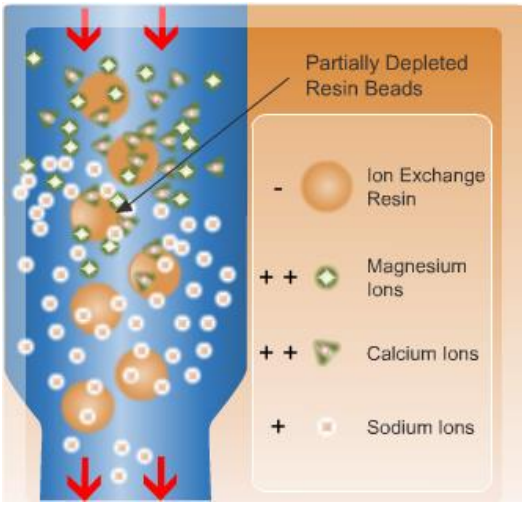
How much iron or manganese causes problems in water?

There is no pat answer to this question, because it varies with each household situation. EPA Secondary Drinking Water Standards set iron and manganese criteria based on levels that cause taste and staining problems. For most individuals, 0.3 parts per million (ppm) of iron and 0.05 ppm of manganese is objectionable. In natural waters iron and manganese generally do not exceed 10 ppm and 2 ppm, respectively.

The most common processes for removing iron and manganese from water are:

- **Aeration**. Aeration is the physical agitation of water which oxidizes minerals, causing them to precipitate (solidify). The process requires an aeration tank or tower, a source of pressurized air (although sometimes an open media and gravity are used) and a sand filter. Once aerated, filtration is required to remove the precipitate from the water. The filter will require periodic backwashing to remove trapped particulate matter.

- **Polyphosphate treatment**. In their soluble forms, iron and manganese may be stabilized or sequestered by adding polyphosphates or organic sequestering agents. Polyphosphates are also used to inhibit corrosion.
- Polyphosphates react with dissolved iron and manganese by trapping them in a complex molecule that is water soluble. As a result, iron and manganese are not available to react with oxygen and do not precipitate. Polyphosphates and organic sequestering agents can be fed into the water system with controlled injection equipment. The application must take place before any aeration or chlorination. Treated water should also not be heated as polyphosphates are unstable at high temperatures. Sodium hexametaphosphates may be used at dosages of about 5 mg per mg of iron. In a distribution system, polyphosphate dosages should be limited to less than 10.0 mg/L, because excess phosphorus can stimulate bacterial slime growth. Chlorination following the addition of polyphosphates may help control this growth.
- For low levels of iron and manganese, polyphosphates are a relatively inexpensive water treatment. However, local ordinances may restrict the concentration of phosphates allowed in municipal discharges to receiving waterways.
- **Ion exchange***.* Ion exchange involves removing contaminants by adsorption of contaminant ions onto a resin exchange medium. This technology is also useful for removing minerals that cause hardness, inorganic chemicals or heavy metals.



As the name implies, one ion is exchanged for another on the charged surface of the medium, usually a synthetic plastic resin. The resin surface is designed as either cationic (positively charged) or anionic (negatively charged). The medium is saturated with the exchangeable ion before treatment operations begin. After the medium reaches equilibrium with the contaminant ions, the medium is regenerated with a suitable solution, generally sodium chloride or potassium chloride. Because of required downtime, the shortest economical regeneration cycles are often once per day. Ion exchange waste is highly concentrated and requires careful disposal.

Precipitation of iron and manganese by oxygen is one of the disadvantages of ion exchange. Some of the precipitate becomes tightly bound to the exchange resin and over time reduces the exchange capacity by plugging pores and blocking exchange sites. If iron bacteria are present, the problem is worse. Also, if suspended particles of insoluble forms of iron or manganese are present in water prior to softening, they will be filtered out on the resin and cause plugging. Suspended iron and manganese should be filtered out before entering the ion exchange process. Problematic iron bacteria can at times be eliminated by chlorinating and filtering the water at some point before ion exchange. When iron and manganese levels are higher than recommended by the manufacturer, iron and manganese removal will be necessary prior to ion exchange.

- **Greensand (Adsorptive/ Oxidative) Filtration** A “greensand” filter is another process used to treat water for iron and manganese. The active material in greensand is glauconite. Glauconite is a green clay mineral that contains iron and has ion exchange properties.

Glauconite is often mixed with other material as small pellets, thus the name "greensand." The glauconite is mined, washed, screened and treated with various chemicals to produce a durable greenish-black product with properties that allow it to adsorb (that is, collect in a condensed form on a surface) soluble iron and manganese. Chlorine is also often injected prior to filtration to oxidize these contaminants and provide greater precipitation.

As water is passed through the filter, soluble iron and manganese are pulled from solution and later react to form insoluble iron and manganese. Insoluble iron and manganese will build up in the greensand filter and must be removed by backwashing. Regular backwashing is essential for effective filter performance and requires flow rates that are often three to four times the normal usage rate. Backwashing should be done twice a week or as recommended by the manufacturer. Eventually, greensand must also be regenerated by washing with a permanganate solution. Regeneration frequency depends on levels of iron, manganese and oxygen in the water as well as the size of the filter. Manufacturer's recommendations should be followed.

- **Chlorination (Oxidation) Plus Filtration.** Chemical oxidation followed by filtration is the accepted method of iron and manganese removal when concentrations are greater than 10 ppm. Chlorine is generally used for this procedure.

  In a chlorination plus filtration procedure, a chlorine solution is injected with a chemical feed pump ahead of a sand filter. Soluble iron and manganese begin to precipitate almost immediately after contact with the chlorine solution. However, approximately 20 minutes of contact time is needed for the precipitate to form particles that can be filtered. This type of system will remove both soluble and suspended particles of insoluble iron and manganese from source water. Backwashing the sand filter to remove precipitated iron and manganese is an important part of continued filtration. As with a greensand filter, system flow rate should be checked to ensure it can provide rates needed for backwashing.

An additional advantage of the chlorination method is its bactericidal effect. Iron and manganese bacteria, along with other bacteria, are destroyed and potential clogging problems in the sand filter are eliminated.

3.1.5 - Corrosion Control

Corrosion is the deterioration of a substance by chemical reaction. Lead, cadmium, zinc, copper and iron can be found in water when metals in water distribution systems corrode. Drinking water contaminated with certain metals, such as lead and copper, are health hazards. Corrosion also reduces the life of water distribution systems and can promote the growth of microorganisms, resulting in disagreeable tastes, odors, slimes and further corrosion.

Because it is widespread and highly toxic, lead is the corrosion product of greatest concern. Using lead-free solders, such as silver-tin and antimony-tin, is a key factor in lead corrosion control. Oregon banned the use of lead-containing materials for public water systems in 1985, but in 2014, Congress made a more stringent standard defining what products are “lead-free.” Now all solder, flux, pipes, plumbing fittings, and fixtures added to public water systems (whether for new installation or repair) must contain no more than 0.25% lead.

The highest level of lead in consumers’ tap water is found when it has been standing in pipes after periods of nonuse (overnight or longer). Standing water tends to leach more lead or copper out of the metals in the plumbing system than does moving water.

Therefore, the simplest short-term or immediate method of reducing exposure to lead in drinking water is allowing water that has been standing for some time to run for two to three minutes before use. Similarly, drinking water should not be taken from the hot water tap, as hot water tends to leach lead more readily than cold.

Long-term measures for addressing lead and other corrosion by-products include:

- ***Alkalinity and pH Adjustment.*** Because it is simple and inexpensive, adjusting pH and alkalinity is the most common corrosion control method.

Alkalinity is a measure of water's ability to neutralize acids while pH is a measure of the concentration of hydrogen ions present in water. Generally, water pH less than 6.5 is associated with uniform corrosion, while pHs between 6.5 and 8.0 can be associated with pitting corrosion. However, carbonate and alkalinity levels affect corrosion as well.

Generally, an increase in pH and alkalinity will decrease corrosion rates and help form a protective layer of scale on corrodible pipe material. Chemicals commonly used for pH and alkalinity adjustment are hydrated lime (CaOH2 or calcium hydroxide), caustic soda (NaOH or sodium hydroxide), soda ash (Na2CO3 or sodium carbonate) and sodium bicarbonate (NaHCO3, essentially baking soda). Care must be taken to maintain pH at a level that will control corrosion but not conflict with optimum pH levels for disinfection and control of disinfection by-products. Because this is a complex subject, professional help is recommended to find the best course of action for your particular situation.

- ***Corrosion Inhibitors.*** Inhibitors reduce corrosion by forming protective coatings on pipes. The most common corrosion inhibitors are inorganic phosphates, sodium silicates and mixtures of phosphates and silicates. These chemicals have proven successful in reducing corrosion in many water systems.

  The phosphates used as corrosion inhibitors include polyphosphates, orthophosphates, glassy phosphates and bimetallic phosphates. In some cases, zinc is added in conjunction with orthophosphates or polyphosphates. Glassy phosphates, such as sodium hexametaphosphate, effectively reduce iron corrosion at dosages of 20 to 40 mg/L.

  Sodium silicates have been used for over 50 years to inhibit corrosion. Effectiveness depends on the water pH and carbonate concentration. Sodium silicates are particularly effective for systems with high water velocities in the pipes, low hardness and alkalinity and a pH of less than 8.4. Typical coating maintenance doses range from 2 to 12 mg/l. They offer advantages in hot water systems because of their chemical stability and consequently are often used in steam heating system boilers.

- ***Coatings and Linings*** Mechanically applied coatings and linings differ for pipes and water storage tanks. Generally, they are applied prior to installation, though some pipes can be lined after installation.

  The most common pipe linings are epoxy paints; cement mortar, polyethylene and coal tar enamels. The most common types of storage tank linings include vinyls, epoxys and coal tar paints and enamels. The National Sanitation Foundation (NSF), an independent testing lab, maintains lists of paints and coatings that are acceptable for potable water applications.

- ***Cathodic Protection*** Electrolysis can cause steel storage tanks to corrode internally. Electrolysis occurs when metallic ions are released by steel and flow through water, which is electrically conductive.

  Electrolysis in water can be overcome by installing a “sacrificial anode,” usually composed of magnesium or zinc, and connecting it to the positive side of a DC power source. The wall of the reservoir is connected to the negative side of the power supply. This tends to reverse the flow of electrons from the anode (hence the term sacrificial), through the water and back to the reservoir wall; essentially turning the steel wall of the reservoir into a cathode — or negative terminal. The result is reduced migration of metallic ions from the steel.

3.1.6 - Nitrate Removal

Nitrates in drinking water can come from fertilizers, sewage, and animal waste. It is a concern in areas with intensive agriculture or residential areas with large concentrations of septic systems.

Sensitive populations, including infants less than 6 months old, pregnant women and people with certain blood disorders, are prone to methemoglobinemia or “blue-baby syndrome” when consuming water with high levels of nitrates. Excessive levels of nitrate have been known to react with intestinal bacteria in some children, changing nitrate to nitrite that in turn reacts with the hemoglobin in the blood. The reaction reduces the oxygen-carrying ability of blood. Because this response can happen quite rapidly; a single exposure to water containing high nitrates is an acute health concern.

Common methods of nitrate removal include reverse-osmosis membrane filtration, electro-dialysis reversal, or an ion-exchange process

3.1.7 - Arsenic Removal

Arsenic is the twentieth most common element in nature and the twelfth most abundant element in the human body. However, too much arsenic is unhealthy. In large enough doses, arsenic can cause health problems including:

- Cancer of the bladder, lungs, skin, kidneys, nasal passages, liver and prostate
- Cardiovascular disease
- Pulmonary disease
- Immunological deficiencies
- Neurological problems
- Endocrine (diabetes)
- Anemia

Arsenic occurs naturally in soil and rocks, which is why it is often found in groundwater wells. This mineral is especially abundant in the western United States. There are two types of arsenic: arsenite (As3) and arsenate (As5). Arsenite is very difficult to remove from drinking water and needs to be oxidized in order to change it to arsenate. Once it has been changed into arsenate, it can be removed by various methods.

The most common methods of removal are conventional filtration and the ion exchange process. Reverse osmosis has been used successfully by small systems to treat arsenic and should be considered as a viable option.

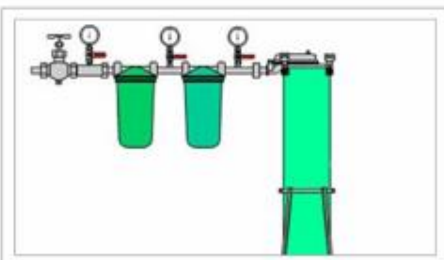
3.1.8 - Filtration

Filtration is the process of removing suspended solids from water as it passes through a porous bed of materials. Natural filtration removes most suspended matter from ground water as it passes through porous layers of soil into aquifers (water-bearing layers under the ground).

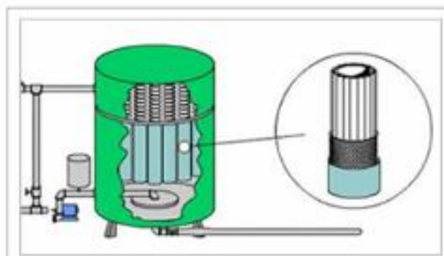
However, surface waters are subject to runoff and are inherently vulnerable to contamination from sewage overflows, industrial discharges and fuel or chemical spills.

Surface water systems must be filtered in addition to being disinfected prior to use. Current filtration technologies include cartridge filters, diatomaceous earth, slow sand and conventional rapid sand filtration. Each type has its benefits and tradeoffs depending on the particulars of any application. Contact your local health department or the DWS for more information.

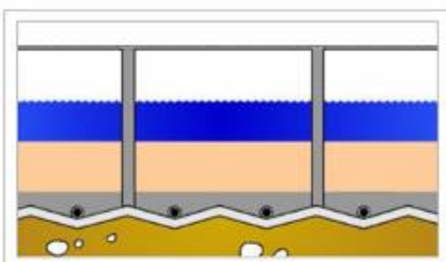
Types of Filtration



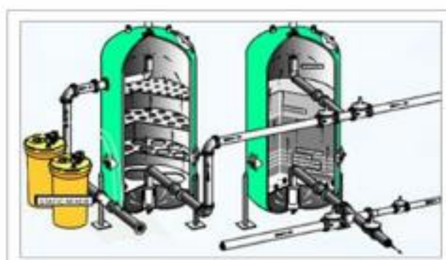
• Cartridge filters



• Diatomaceous earth



• Slow sand



• Rapid sand filtration

UNIT 3: Operations

FACT SHEET 3.2 - Developing and Maintaining an Operations & Maintenance Manual

Sample Form 1: Routine Operational Procedures & Schedule

Sample Form 2: Operations Plan for Small Systems with Chlorination

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.2 - Developing and Maintaining an Operations & Maintenance Manual

An **Operations and Maintenance (O&M) Manual** is a written document explaining how a public water system is to be operated on a day-to-day basis to ensure public health, safety and compliance with applicable regulations.

The O&M Manual is one of a water purveyor's most crucial documents. In addition to being an important guide for any new staff, the O&M Manual is a critical tool in assuring the public continues to receive safe, adequate drinking water in cases where existing staff is unavailable to operate the system.

The O&M Manual should be prepared in such a way that it could explain to another operator how to run the water system and keep it in compliance. The manual should be individually tailored to each water system's size, source water, treatment, water quality, distribution system and available resources. The O&M Manual should provide a complete and accurate view of the water system's operation. The system owner and operator should be involved in creating and maintaining the O&M Manual.

Creating an original O&M Manual will require some work. Each suggested step below results in the production of a document. Together these documents comprise the full manual. Also, see sample forms included at the end of this section.

1. Prepare a description of all water system facilities. Use an existing description if available.
2. Provide a list of all operational personnel. Include employee name, job title, certification, operator certification number and grade level.
3. Develop a list of routine (daily, weekly, monthly) operational tasks for all operating personnel. For complex tasks, provide a separate detailed description of the steps involved with each task. Review and document procedures that are adequate to meet regulatory requirements.
4. Develop procedures that address operation and maintenance (routine and preventative) of all system components.

5. Describe procedures to comply with all operational requirements that are specified by the regulatory agency or in a water system survey report.
6. Provide a description of operation, maintenance and record keeping procedures.
7. Prepare a list of past significant operational problems and steps taken to correct them. Establish procedures to respond to these operational problems should they recur.
8. Include a copy of the Coliform Sampling Plan, which is current, accurate and approved by OHA or your county health department.
9. Include a copy of the Emergency Response Plan, which is current, accurate and approved by OHA or your county health department.
10. For any treatment of a surface water source, develop and maintain an accurate and complete Surface Water Treatment Operations Plan.

Information should be categorized in a manner that is practical and easy to find for water system staff. One way to organize the information is shown in the following example

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*

Once the O&M Manual is created, it should not be left on a shelf to gather dust. If an O&M Manual is not reviewed regularly, it is not being properly used. The manual should be a regular topic of discussion at staff or board meetings. Once the document is created, it needs to be reviewed and updated at least annually. Remember, there are always changes within a public water system; not only staff changes, but system component and regulation changes as well. Without updates, such factors could make an O&M Manual obsolete and defeat the purpose of creating it.

Sample forms:

- Sample Form 1: Routine Operations Procedure & Schedule.
- Sample Form 2: Operations Plan for Small Systems with Chlorination.

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	____________________

***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 to the DWS by the 10th of the month following the sample.
   1. If sample is positive, notify DWS and take required repeat and source samples.
   2. Take five routine samples the month following a positive sample.
   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 NOTIFICTION** 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**.
1. Name and address of supplier and type of equipment.

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

C. List of distributors or suppliers of **replacement parts** for the system.
1. Name and address of supplier and type of equipment.

Name	Address	Phone #	Equipment
____________	___________	________	PVC pipe, valves, and fittings
____________	___________	_________	Pumps, pressure tank & gauges
____________	___________	_________	Chlorinator

D. List of **emergency contact numbers**:

	Name	**Phone #**
1.	Local County Health Department or OHA Contact	_______________
2.	Law Enforcement	_______________
3.	Electrician	_______________
4.	Laboratory	_______________
5.	Pump repair service	_______________
6.	Chemical disinfectant supplier	_______________
7.	Equipment supplier	_______________
8.	Owner	_______________

OWNER/OPERATOR

- **Operational Personnel List:** List each person who is involved in the operation of the water system (including treatment and distribution) and their responsibilities:

	Name	Title	Phone #	*System Responsibilities*
1.	________	Board Chair	_________	Pays bills and makes major decisions
2.	________	Manager	_________	Maintains office and performs related duties, keeps Board informed. Makes routine/normal financial decisions.
3.	________	Operator	_________	Operate and maintain the water system components.
4.	________	Laboratory Tech	_________	Take samples as necessary.

- **Consumer complaint response procedures**. Example procedure is described below.

a. CONSUMER COMPLAINT RESPONSE PROCEDURE

1. Record in complaint log (name, address and nature of the problem).
2. Investigate the complaint.
3. Verify or dismiss the complaint.
4. Record the steps taken to address or correct the problem.
5. Notify complainant of action taken.

Keep complaint records with corrective action for five years.

UNIT 3: Operations

FACT SHEET 3.3 – Recordkeeping

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.3 – Recordkeeping

Records are very important in supporting the effective operational, administrative and financial aspects of water system management. Too often, when board members or operators move away or are no longer involved with system management, institutional knowledge is lost because of poor recordkeeping.

Good practice deems that records should be kept as long as legally required and/or as long as they are deemed useful. State rules (OAR 333-061-0025)(6) require that monitoring and operating records be made available when the system is inspected. In addition, OAR 333-061-0040(2) sets specific retention requirements. Those requirements are set forth in parentheses in the list below. Good management practice also dictates that a variety of other records be kept as well. Records to keep in a safe but available place include:

Equipment and maintenance records

- Well logs;
- Name and type of pumps;
- System documents showing layout, "as-built," maps, etc.;
- List of equipment with make and model numbers and date purchased;
- Equipment manuals;
- Ledger of completed maintenance work;
- Operational logs (run times, meter readings, settings, observations, etc.);
- Schedule of future maintenance needs and general physical condition of equipment;
- Procurement records (ordered parts and supplies to forecast future needs).

Sampling and monitoring compliance records

- Coliform Sampling Plan;
- Total coliform test results (at least 5 years);
- All other lab analysis results (for at least 10 years);
- Actions taken to correct any non-compliance issues (3 years);
- Issued public notices (at least 3 years)

Planning and management documents

- Operation and maintenance manual;
- Consumer Confidence Reports;
- Emergency response plans;
- Water system surveys, reports, communications, etc. (10 years);
- Other system-developed programs, such as water conservation and cross-connection control.

Administrative & legal records

- System permits;
- Records of any variances or permits (5 years);
- Water Rights Documents (indefinitely);
- System ordinances, resolutions, by-laws, etc.;
- Financial records (monthly financial reports, annual budgets, etc.);
- Public meeting records;
- Personnel records (kept confidentially).

UNIT 3: Operations

FACT SHEET 3.4 – Shock Chlorination Procedures for Wells

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.4 – Shock Chlorination Procedures for Wells

Wells may need to be disinfected to eliminate organisms that may have entered the source during major repairs or other instances. More specifically, chlorination is recommended under the following circumstances:

- After construction of a new well;
- After maintenance of an existing well where the sanitary seal is broken;
- After a positive coliform sample or other contamination event; or
- As a preventative measure to kill biofilms that may have built up in the well casing.

The chlorination procedure involves first determining the volume of standing water in the well, and then calculating the appropriate amount of chlorine solution to add to the well. OHA recommends introducing into the well a solution consisting of 50 ppm chlorine.

The following table can be used to determine the volume of water in the well.

Main diameter, inches	Gallons/foot of length
4	0.65
6	1.5
8	2.6
10	4.1
12	5.9
14	8.0

To calculate the amount of chlorine solution needed, see *UNIT 4 – Specifics for Systems with Treatment*.

Pour the needed amount of chlorine solution into the well, either through the well seal vent port or by carefully removing the seal on the well head.

Recirculate the well water though the hose back into the well (through the vent port or into the open casing) to thoroughly mix the chlorine solution with the well water. Try to wash down the interior walls of the well during the process. Recirculate 1 to 2 hours. Replace the well seal and screened vent.

Open all faucets connected to the system, until a strong odor of chlorine is detected. The solution should stand for 24 hours, to allow sufficient contact time for disinfection to occur. After 24 hours, run the faucets and let the chlorinated water flush out until the odor of chlorine dissipates. ***Make sure the chlorinated water is disposed of in an environmentally safe manner, away from the vegetation.***

As a final step, bacteriological testing should be conducted after disinfection. Consumers will need to wait until bacteriological testing shows the water is safe to drink before using the water. Always provide affected consumers with advance notice of when the emergency chlorination process will occur and when to expect potable water to be returned to the system.

UNIT 3: Operations

FACT SHEET 3.5 – Leak Prevention & Repair

3.5.1 - Overview of Steps

3.5.2 - Using an Emergency Plan

3.5.3 - Ensuring Staff and Public Safety Before, During and After Pipe Repair

3.5.4 - Notifying Other Utility Companies

3.5.5 - Notifying Customers of Possible Water Outages

3.5.6 - Using Proper Construction Practices and Testing for Leaks

3.5.7 - Disinfecting Repaired or New Lines and Testing for Bacteria

3.5.8 - Keeping Proper Documentation

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.5 – Leak Prevention & Repair

3.5.1 – Overview of Steps

All water systems will have leaks in their water pipes. Some leaks are very small and may go undetected for long periods of time.

However, when a leak is discovered it must be repaired to protect public health (backflow possibilities) and reduce costs (wasting water). Operators should have a written Emergency Response Plan and an Operation and Maintenance Manual for reference that address the following when dealing with leaks:

- Ensuring staff and public safety before, during and after the repair;
- Notifying other utility companies (i.e., gas, electrical) of repair work;
- Notifying customers of possible water outages;
- Using proper construction practices and tests for leaks;
- Properly disinfecting repaired lines and test for coliform bacteria;
- Keeping proper documentation.

More information on each of these steps follows.

3.5.2 – Using an Emergency Response Plan

In addition to an updated Operations and Maintenance Plan, all water systems should have a written emergency response plan that addresses a variety of types of emergencies including water pipe leaks and breaks. It is also a good idea to practice the steps in the plan to determine if all issues have been addressed. There are many good templates that can help you create an emergency response plan.

Water systems should have all parts needed to repair a pipe leak or break on the site to prevent workers from having to scramble on a Sunday afternoon to find a repair clamp or other part.

It is also important to have the necessary tools on hand. Small water systems that do not own heavy equipment should have a plan or agreement with a local heavy equipment supplier so severe leaks or breaks can be quickly repaired.

3.5.3 - Ensuring Staff and Public Safety Before, During and After Pipe Repair

When a leak is discovered, water system staff should immediately determine the best and safest method of repair. Staff should have and use safety equipment such as bright clothing, cones, barricades and flashing lights.

It is a good idea to have a plan of action for emergency repairs in the emergency response plan. Practicing such a plan can make an emergency seem more like a routine repair. Whether a pipe is dug up by hand or by heavy equipment, safety should always be the primary concern.

Protection of public and private property is also important, as are potential safety issues involving traffic and pedestrians. If a leak is severe and could cause property damage, it must be addressed immediately. Control water loss by a complete or partial line shut down. Only after the following issues have been addressed, will it be time to dig up the pipe and repair the leak.

3.5.4- Notifying Other Utility Companies

Other utilities place their pipes and wires underground for public convenience. Oregon requires notification of all utility companies when any other utility will be digging more than 12 inches in public rights of way.

Notification must be given two working days prior to any digging, or as soon as possible for emergency work. Prior notice prevents damage to other utilities such as phone, cable, electric or sewage lines as well as any other utilities that may be in the area.

Providing no prior notice not only inconveniences the public, but also makes water systems financially liable for any damage done to other utilities' property.

3.5.5 - Notifying Customers of Possible Water Outages

Leaking water pipes need to be partially or completely shut off for repair. However, low pressure or no water can be a hardship — even harmful or life-threatening — to water system customers.

When a drop in water pressure or a water outage is expected, every effort should be made to notify any customers who have sprinkler systems or water cooled refrigeration units as well as industrial, agricultural and medical equipment users (i.e., kidney dialysis machines). Notification is especially important for hospitals, senior citizen complexes, health clinics or any other medical facility. If the leak is at the bottom of a hill, customers at higher elevations should be advised to shut off their inlet valves to prevent draining of hot water heaters or water softening units.

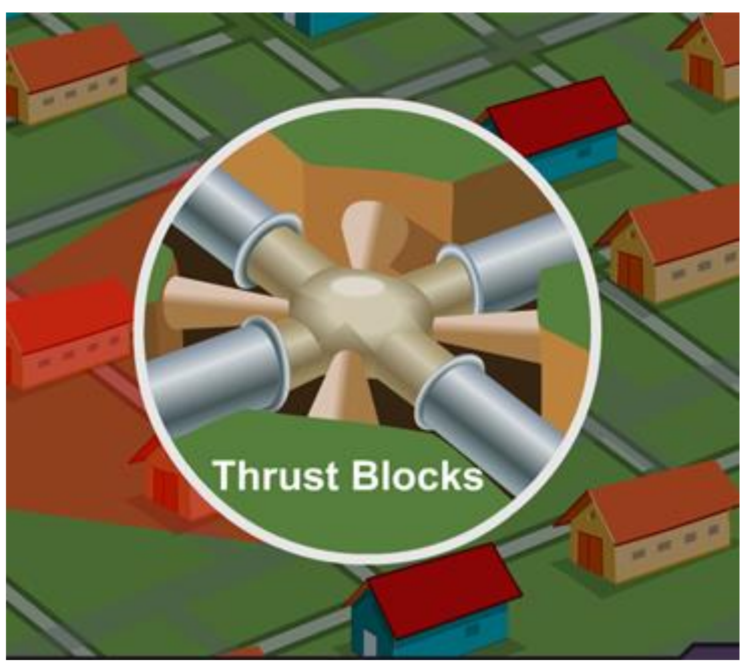
3.5.6 - Using Proper Construction Practices and Testing for Leaks

All pipe installation and repair should be done in accordance with good construction practices. All water mains should be installed under a minimum 30 inches of ground cover to prevent freezing and damage from traffic. All pipes should be bedded and backfilled properly to allow for surface loadings. Thrust blocks should also be installed on any valves, tees, bends or appurtenances to prevent connections from coming apart when under pressure. Disinfection of materials used for repair is recommended, and disinfection of pipe is required if pressure was lost and/or new sections of pipe were installed. The following section outlines the procedures to follow. Once the repair has been made, the line should be tested for leaks by using pumps to put the pipe under higher than normal pressure. If this is not possible, use system pressure as an indicator of any leaks.

3.5.7 - Disinfecting Repaired or New Lines and Testing for Bacteria

OHA rules require disinfection after installation of new lines or repairs to old lines.

Disinfection is the process of killing microorganisms in water that can cause disease (pathogens).



Chlorination is the most widely used form of disinfection. A solution of at least 50 ppm chlorine must be injected into the line with no less than 25 ppm free chlorine residual measured after a minimum of 24 hours.

The first step involves determining the volume of water to be disinfected. To calculate the volume of water in a section of pipe, use the following table.

Main diameter, inches	Gallons/foot of length
2	0.16
4	0.65
6	1.5
8	2.6
10	4.1
12	5.9

Example:

Let’s say you just installed 290 feet of 4" main. Before putting it into service, it needs to be disinfected. Calculate the volume of water in gallons using the above table.

One foot of 4" pipe contains 0.65 gallons of water per foot of length. Therefore:

$0.65 \times 290 = 190$ gallons.

To calculate the amount of chlorine solution needed, *see UNIT 4 - Specifics for Systems with Treatment.*

After disinfection and flushing the highly chlorinated water from the main, a water quality test for coliform bacteria must be performed before it can be placed back into service. If the sample determines the presence of coliform, re-chlorinate the line following the same procedure, flush and retest. If coliform is absent, place the water line back into service.

***Remember, chlorinated water must be disposed of in an environmentally safe manner*.**

3.5.8 - Keeping Proper Documentation

Repairs performed on water systems should be documented. Documentation helps staff complete future repairs and demonstrates the need for system upgrades and improvements. Documentation should include:

- Depth of pipe
- Type of pipe and fittings
- Any unusual conditions
- Any other utilities in the area
- Type of repair
- Date of repair
- Who performed the repair
- Changes (if any) to system maps
- Changes (if any) to the O&M Manual

UNIT 3: Operations

FACT SHEET 3.6 - Facility Operation and Maintenance

3.6.1 - Understanding a Pressurized System

3.6.2 - Understanding and Implementing a Flushing Program

3.6.3 - Understanding and Implementing a Valve Exercising Program

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

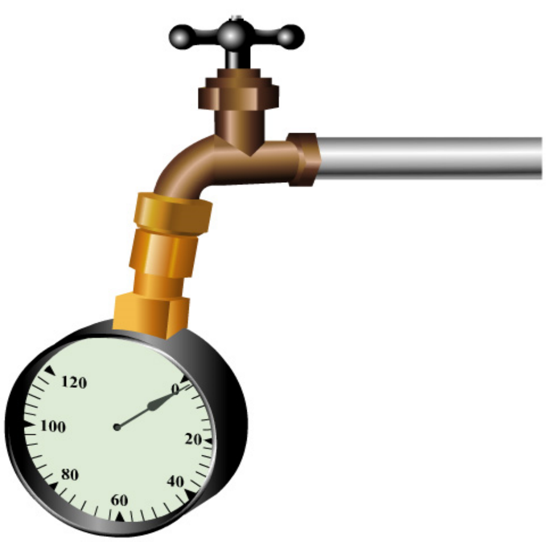
FACT SHEET 3.6 - Facility Operation and Maintenance

3.6.1 – Understanding a Pressurized System

Water in the distribution system must be under pressure at all times. **Pressure** allows water to go where it needs to go and prevents contaminants from entering the distribution system through **backflow**. Backflow is the reversal of the normal direction of water flow in piping and is a source of entry for non-potable water.

For example, positive pressure within a system can be compromised if large quantities of water are pumped out for fire suppression. Distribution systems are designed for certain flows and pressures. If normal flows are exceeded, system pressure can drop. If pressure drops, any **cross connections** without backflow protection devices could result in backsiphoning of non-potable water into the distribution system. The result is contaminated drinking water (See Section I, Part 5 for more information on cross connections).

Pressure is provided by the direct force (e.g., from a pump), or by elevation (e.g., storage reservoir). Pressure is measured in **pounds per square inch, or psi.** One psi is equal to 2.31 feet of water or one foot of water is equal to 0.433 psi.



pounds per inch (psi)

1 psi = 2.31 feet of water

1 foot of water = 0.433 psi

For ordinary domestic use, water pressure should be a minimum of 35 psi. A minimum of 60 psi is usually adequate for a fire hydrant. This amount of pressure allows for a pressure drop of up to 20 psi when fire hoses are used. In commercial and industrial districts, it is common to have 75 psi or higher. According to state regulations, a public water system's distribution piping must be designed and installed to assure a minimum pressure of at least 20 psi throughout the distribution system under all conditions of flow.

Pressure tests should be performed several times a year at a number of locations within the distribution system. Ideally, pressure should be measured close to the pumping station, midway in the distribution system and as close to the end of the system as possible.

If positive pressure at the end of a system cannot be maintained during times of high use, booster pumps should be installed. Pressure tests help operators monitor system performance and identify leaks. To provide constant evaluation of system pressure, it is also helpful to have some locations continuously monitored.

3.6.2 – Understanding and Implementing a Flushing Program

A variety of impurities, such as sand, iron and manganese from the well source can build up in the system promote bacterial growth creating cloudy water, or taste and odor problems at the tap resulting in customer complaints. They can also obstruct the proper operation and shorten the life expectancy of meters, valves and other system components. Iron buildup, manganese and turbidity issues can be corrected by flushing programs.

Most water systems' flushing programs consist of opening fire hydrants (or special flushing hydrants) throughout a water system. If fire hydrants are not available, installation of hydrants or blow-off valves in strategic locations should be considered a priority.

When establishing a flushing program factors such as size of water pipes, locations of flushing outlets, locations of main valves and the ability to dispose of large quantities of water must be considered. Flushing program procedures should be documented to ensure they are done correctly. Flushing at blow offs on dead end lines and at fire hydrants throughout the system should be done at least once a year, more often if water quality problems exist.

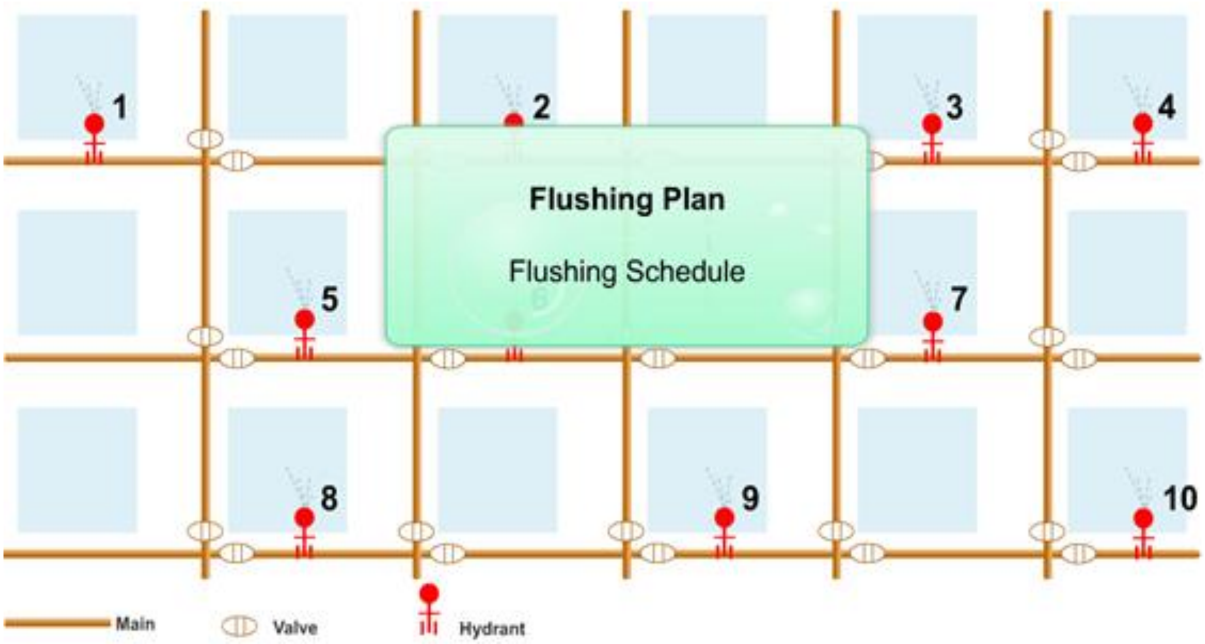
When implementing a flushing program:

- Include a map of water system with hydrants marked and numbered;
- Attach a sheet with the schedule and order in which the hydrants will be flushed;
- Allow only trained staff to flush hydrants (open and close slowly to avoid water hammer or other damage);
- Ensure that detailed procedures are in place to notify customers that some dirty water may be created, and what they should do to flush their lines (run water for a few minutes);
- Begin flushing with the hydrant closest to the pump station or storage tank, then move to the next hydrant (this way, clean water is chasing out dirty water);
- Inspect each hydrant during flushing for leaks, ease of operation, ease of access, painting needs, etc., and document those findings;

Ensure flow from a hydrant does not cause damage to property or cause a distraction to drivers;

- If water is flowing into a storm drain or water way, make sure to first de-chlorinate the chlorinated water.
- Document the number of turns needed to open and close hydrants, length of time flushed (at least 2-3 water changes in pipe), findings from inspections, name of operator and so forth.

Sample flushing plan map.



3.6.3 - Understanding and Implementing a Valve Exercising Program

Water main line valves are water system components that often get ignored. **Water main line valves** are usually installed on underground water pipes throughout a water system. Valves isolate sections of water pipes so that installation, repair, replacement or maintenance of the water system can be performed.

In case of an emergency, valves also isolate storage tanks or other parts of the distribution system. Draining a storage tank can cause insufficient pressure for fire protection or adequate water supply.

Debris built up in valves that have not been properly exercised can make it impossible to shut them off completely, or even cause them to fail. Dealing with shut off problems or complete failure is much more time consuming and expensive than simply creating a valve exercising program. Water main valves should be exercised at least annually.

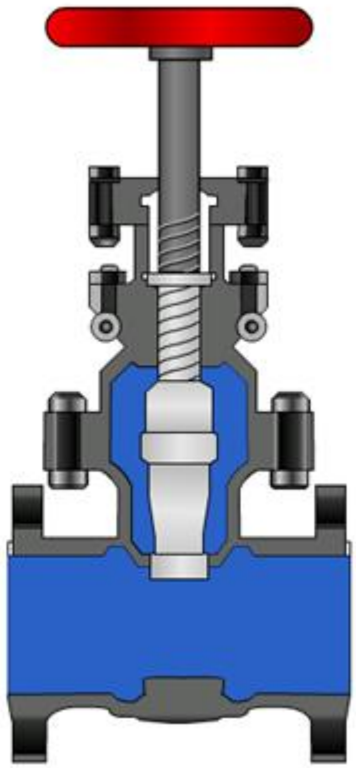
If water quality is poor due to sediment, iron and manganese or other constituents, a more frequent exercise schedule should be considered.

When implementing a valve exercising program:

- Include a map of water system with valves marked and numbered
- Attach a sheet with a schedule and order in which the valves will be exercised;
- Make sure only trained staff exercise main valves (open and close slowly to avoid water hammer or other damage);
- Notify customers that some dirty water may be created, and what to do to flush lines (run the water for a few minutes);
- Begin exercising valves as described in the documented plan;
- Since most valves are located in street areas, be sure to follow safety requirements and precautions (barricades, cones, safety vests, etc.); Inspect and clean valve boxes and document each valve for leaks, ease of operation and number of turns to open/close (if number changes, consider valve replacement);
- Document inspection findings, name of operator, date, etc.;

Other tests which should be conducted at a minimum of once a year are: flow test, pressure test, fire hydrant inspection, and others. These tests should be done after the hydrant and flushing exercises to assure accurate and comparable results.

Example valve (gate valve)



UNIT 3: Operations

FACT SHEET 3.7 - Cleaning and Maintaining Storage Tanks

3.7.1 - Overview of Storage Tanks

3.7.2 - Developing a Maintenance Program

3.7.3 - Storage Tank Chlorination

Table - Disinfection of reservoirs to achieve a 25 ppm chlorine dose

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.7 - Cleaning and Maintaining Storage Tanks

3.7.1 – Overview of Storage Tanks

Storage facilities allow water systems to meet fluctuating water demands. Their primary purpose is to store water. The storage volume should be equal to between one and three days of the system's average daily use.

Storage tanks should be located at a high enough elevation to allow the water to flow by gravity to the distribution system. This, coupled with consumer use, should provide an uninterrupted water supply in the event of pump failure, loss of power or acute contamination event (sewage bypass, fuel or chemical spill, etc.). Also, if feasible, fire protection storage should be provided.

Storage tanks are also used as detention basins to provide required chlorine contact time necessary to ensure adequate disinfection. As such, the contact time in a storage tank is greatly improved when constructed with a separate inlet and outlet pipe, preferably located on opposite sides and at different levels. Also, baffles inside the storage tank (walls, curtains, or spirals) increase contact time by preventing water from leaving the storage tank too quickly (known as "short circuiting").

3.7.2 – Developing a Maintenance Program

The fact that there are no moving parts in a storage tank, leads some water system operators to believe this piece of equipment does not need maintenance. Anyone who has ignored their storage tank only to have it fail knows differently.

A storage tank that is not maintained is capable of failing (water outage) or allowing contaminants to enter the water supply. Correcting these problems can be significantly more expensive than implementing a preventative maintenance plan.

A good operations and maintenance plan for the storage tank will include a list of maintenance tasks, a list of any potential problems associated with the storage tank, viable solutions and whether or not professional help should be sought. Important components of the maintenance plan will be **visual inspections** as well as **cleaning** of the storage tank.

Visual inspections are used to check physical aspects of the tank as well as signal other issues. Both exterior and interior visual inspections should be conducted. Physical aspects to be aware of in any visual inspection include:

- Leaking;
- Rusting;
- Failed vent screens;
- Inspection hatch problems;
- Electrical components (if any);
- Vandalism.

Other issues that could also affect the system's water quality include:

- Mineral buildup;
- Vent screen failure;
- Stale water;
- Vandalism.

How often should exterior and interior visual inspections be performed and what is involved?

A visual exterior inspection is performed annually at a minimum. In preparation for the exterior inspection, a review of original plans or "as-builts" for the storage tank (dimensions, water levels, controls, etc.) is helpful. As part of the visual exterior inspection, be sure to inspect and document exterior paint, ladders, foundations, bolts, valves, hatches, vents, cathodic protection or any other system components.
Interior inspections should also be done at least annually. A visual interior inspection involves opening the hatch and looking inside, checking the vent screening and ladder

inspection. All findings should be documented.

More frequent inspections for both the interior and exterior of the tank may be needed depending on the type of tank, age, location, as well as weather conditions and water quality. For example, a newer system with a fenced tank, an alarm system and located near the operator's home, would not need to be inspected as often as an older system that has no security measures and is secluded.

Detected problems should be corrected immediately. Proper coatings should be applied and maintained (touched up) as needed to prolong the life of the tank. Because many tanks are located in isolated places, it is also important to check for potential security problems as part of routine inspections. Examine fencing, locks, lights or any other items used to secure the tank site.

Cleaning of the storage tank should be conducted as needed. Tanks can be drained and then cleaned, or alternatively cleaning can be done by divers and/or mechanical vacuums. Criteria used to determine needed frequency of tank cleaning include:

- Water quality (e.g., mineral content, use of treatment chemicals);
- Local climate and temperature (e.g., algae build up in warm conditions);
- Tank material and condition (e.g., indications of rust);
- Tank age.

If a system's tank has never been cleaned, it may be a good idea to hire a company specializing in tank cleaning that has video equipment. A camera can be lowered into the tank to inspect for tank flaws and/or sediment/mineral buildup. Based on this information, combined with the tank's age, water system owners can determine how often the tank should be inspected and serviced and plan accordingly.

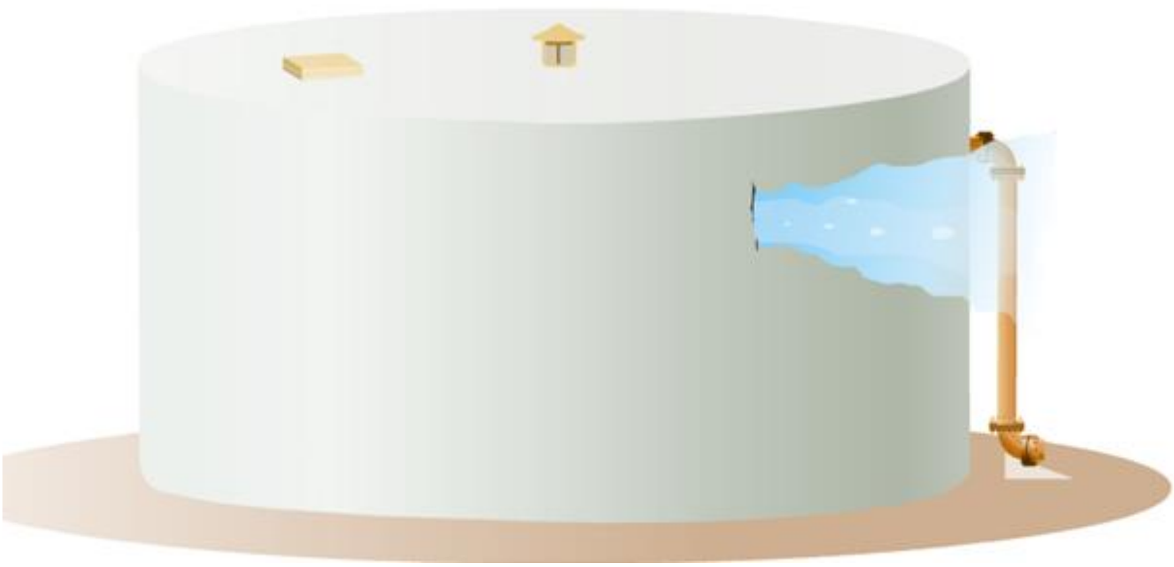
When draining and cleaning a storage tank:

- Make sure customers still have water while the tank is out of service;
- Make sure water being drained does not cause damage or erosion problems;
- Open and close all appropriate valves and drain;
- Treat the tank as a confined space. Have safety harnesses attached to anyone in the tank and a rescue plan in place;

- Clean the tank as needed. This can usually be accomplished with high pressure water hoses;
- Inspect and document the tank interior as recommended by the manufacturer;
- Develop a resolution plan for any issues discovered during the inspection;
- Perform a thorough cleaning, disinfection and bacteriological sampling prior to placing the reservoir back in service;
- Keep records of all maintenance activities.

After draining and cleaning, the tank must be chlorinated as described in the following section.

Leaking Storage Tank.



3.7.3 - Storage Tank Chlorination

After draining and cleaning, it is necessary to clean and disinfect the storage tank before placing it back into service. There are three approved methods of chlorine disinfection:

Method A. Filling the tank or reservoir with a 10 mg/L chlorine solution and allowing it to remain for 24 hours.
Method B. Filling the reservoir with a 50 mg/L chlorine solution and allowing it to stand for 6 hours.
Method C. Spraying or brushing on a 200 mg/L chlorine solution and allowing it to remain for 30 minutes prior to filling the tank.

Table - Disinfection of reservoirs to achieve a 50 mg/L chlorine dose

Reservoir size (gals.)	Gallons of 5% bleach to add to achieve a 50mg/L chlorine dose
1,000	1
2,000	2
3,000	3
4,000	4
5,000	5
10,000	10
20,000	20
30,000	30
40,000	40
50,000	50

Reservoir size (gals.)	Amount (in pounds of dry weight) of 65% strength dry chlorine powder to add to achieve a 25 mg/L dose.
10,000	3.5
20,000	6.5
30,000	10
40,000	13
50,000	16
100,000	32
200,000	64
300,000	100
400,000	130
500,000	160

Regardless of the method used*, chlorinated water must be disposed of in an environmentally safe manner.* Also, after disinfection and flushing a total coliform sample should be taken and tested prior to re-use of the reservoir. Records should be kept of all activities of this type. Such records are useful when scheduling future maintenance.

UNIT 3: Operations

FACT SHEET 3.8 - Accessing the Drinking Water Services Web Site

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.8 - Accessing the Drinking Water Program Web Site

The Drinking Water Services website provides a variety of information to support public water systems in meeting regulatory requirements and providing safe drinking water to customers. The website is accessible at: *http://healthoregon.org/dwp*

The site provides access to current information on rules, upcoming program changes, contacts for free technical assistance available to small systems, templates and historical data and links to the following:

- **Data Online.** A database with information on each public water system in Oregon. This is where the DWS stores all the information about your water system including the primary contact information, sampling schedules, due dates, latest sampling results, record of violations and much more. Operators should monitor their system's webpage to be sure the information is current and accurate.

- **Pipeline Newsletter**. Copies of current and past Pipeline, the newsletter published by the DWS for public water systems in Oregon.

- **Monitoring Information Forms and Fact Sheets.** Tools and information for monitoring and reporting sampling results (e.g., coliform sampling plan template, summary of chemical sampling requirements, proper coliform sampling techniques, waiver forms and guidance, health effects information). Also included are public notice requirements and downloadable templates.

- **Water System Security** Includes information on water system security requirements and emergency preparedness; also links to other resources;

- **Operator Certification** Outlines operator certification requirements. Includes application materials and info on training courses and schedules.

- **Consumer Confidence Reports (CCR)** Gives requirements, templates, a sample CCR and resources to aid in writing a CCR.

- **Plan Review**
  Water system plan review requirements, land use compatibility statement template, and fee schedule;

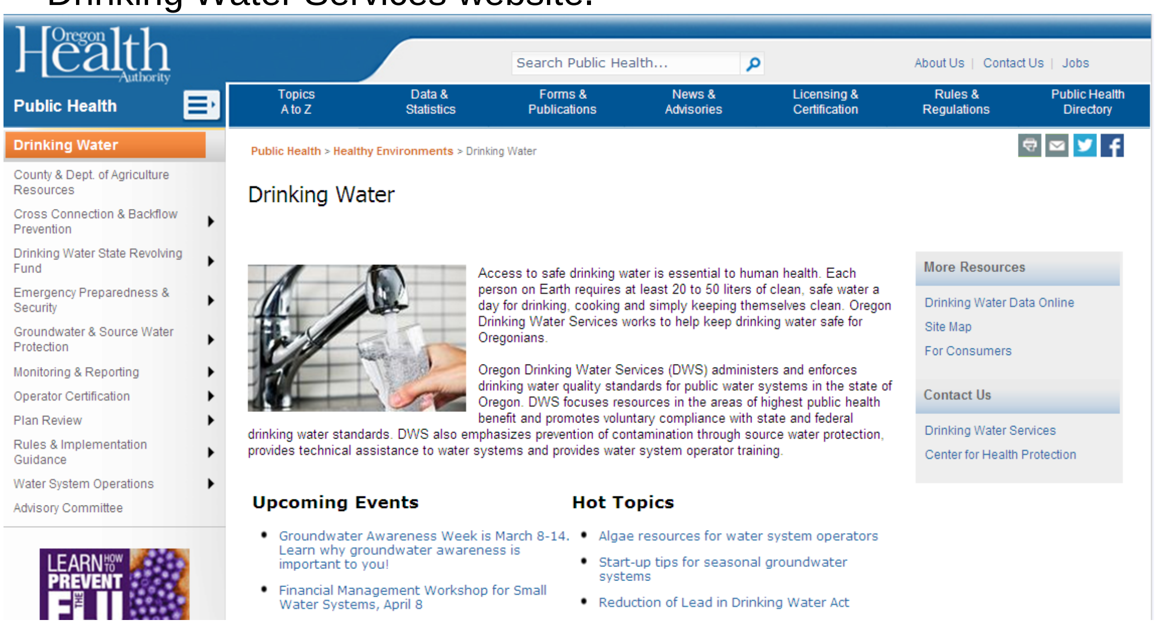
- **Rules and Regulations.**
  Copies of current regulations are available here.

- **Source Water Protection**
  Information on this site is provided for water systems and operators that utilize groundwater and protect groundwater/source water sources. Also provided are downloadable tools and resources.

- Drinking Water State Revolving Fund

- **DWS Staff**
  Contact information for DWS and county health department staff is provided.

Drinking Water Services website.



UNIT 3: Operations

FACT SHEET 3.9 - Who to Call for Help

3.9.1 - OHA Drinking Water Services

3.9.2 - County Health Department Contacts

3.9.3 - OHA Cross-Connection / Backflow Prevention Program

3.9.4 - Drinking Water Protection Program

3.9.5 - Technical Assistance Circuit Riders

3.9.6 –Drinking Water State Revolving Fund

3.9.7 - Industry Organizations & Resources

3.9.8 - State Certified Laboratories

Website pages and/or links mentioned in this manual may change. Visit the drinking water services website for updated information.

FACT SHEET 3.9 - Who to Call for Help

3.9.1 – OHA Drinking Water Services

Use the **DWS technical assistance phone line** to get answers to your questions. DWS staff is available Monday through Friday from 8:00 AM to 5:00 PM to respond to inquiries. **Call 971-673-0405.**

Please make use of this technical assistance phone line unless you feel you must speak with a specific staff member. Contacts are listed below.

(Note: Staff is located in Portland unless otherwise listed)

General Inquiries for Drinking Water Services	
Technical Assistance Line 971-673-0405 8:00 AM – 5:00 PM	**After Hours Emergencies** Oregon Emergency Response System **800-452-0311**
Website: **healthoregon.org/dwp**	

Drinking Water Administration	
Program Manager 971-673-0415	**Administrative Specialist** 971-673-0427
Portland Street Address OHA-Drinking Water Services 800 NE Oregon Street, Ste 640 Portland, OR 97232-2162	**Mailing Address** *For General Correspondence:* PO Box 14450 Portland, OR 97293-0450 info.drinkingwater@dhsoha.state.or.us
For Water Quality Reports PO Box 14350 Portland, OR 97293-0350 dwp.dmce@dhsoha.state.or.us	

Technical Services	
Region 1	
Portland 971-673-0405	**Pendleton** 541-276-8006

Region 2	
Springfield 541-726-2587	**Medford** 541-618-7872

Specific Topics	
Plan Review	971 673-0408
Source Water Protection	541-726-2587
Data Management & Compliance Enforcement	971-673-0470
State Revolving Fund	971-673-0422
Cross Connection	971-673-1220
Operator Certification	971-673-0426
Lab Certification Public Health Laboratory	503-693-4122 Fax 503-693-5602

3.9.2 – County Health Department Contacts

The Drinking Water Services contracts with many county health departments to perform much of the program work at the local level. In addition to contacting the DWS, you may also contact your local health department to get answers to your questions.

3.9.3 – OHA Cross Connection/Backflow Prevention Program

By state law, public water system operators are required to prevent cross connections from existing within their systems. If an actual or potential cross connection exists, installation of an approved backflow prevention assembly is required. The DWS Cross Connection Program Coordinator is available to answer your questions regarding cross connection control and backflow prevention requirements and to assist you in implementing a successful program. Contact the coordinator for answers to your questions.

Cross Connection Program Coordinator:
cross.connection@dhsoha.state.or.us
Ph. 971-673-0321
Fax 971-673-0694

OHA-CC/BPP
PO BOX 14450
Portland, OR 97293-0450

3.9.4 – Drinking Water Protection Program

The Oregon Drinking Water Protection Program is jointly administered by the DWS and the Oregon Department of Environmental Quality (DEQ). The DWS concentrates on assisting communities implement groundwater protection activities, while the DEQ is focused on supporting surface water protection activities. DWS and DEQ staff can help you get started on developing and implementing a drinking water protection plan. Contact the relevant department for more information on drinking water protection.

Oregon Health Authority
Drinking Water Services
Groundwater Protection Coordinators
541-726-2587 Ext. 24

Oregon Department of Environmental Quality (DEQ)
Surface Water Protection Coordinators 503-229-5413

3.9.5 – Technical Assistance Circuit Riders

Through the Drinking Water State Revolving Fund, contracts have been established with drinking water circuit riders to provide on-site technical services to community water systems with populations under 10,000 and non-profit non-community systems. This technical assistance service is **offered at no cost to water systems**.

Circuit riders can assist small water systems with a wide variety of issues, including:

- Operational troubleshooting,
- Emergency operations assistance,
- Equipment and treatment recommendations,
- Guidance on water system planning,
- Submitting applications for project funding.

Contact the state circuit rider for more information and assistance.

***Oregon Small Water System Circuit Rider*:**
HBH Consulting Engineers, Inc.
Phone: 503-625-8065
1-866-669-6603

3.9.6 –Drinking Water State Revolving Fund (DWSRF)

Infrastructure Projects: Each year, Oregon's Drinking Water State Revolving Fund (DWSRF) offers low interest, long-term financing for needed drinking water infrastructure improvement projects. Projects may be to plan, design and/or construct drinking water improvements needed to increase public health protection and maintain compliance with drinking water quality standards. All community and non-profit non-community water systems are eligible to receive funding. Project incentives may include:

- Terms of 20 to 30 years
- Rates of 1% to 4%
- Subsidies (i.e., principal forgiveness)
- Loans up to $6,000,000 (more with DWAC approval)
- Loan forgiveness for sustainability activities, http://www.orinfrastructure.org/. This pilot program provides forgivable loan financing for water system planning and related activities that promote sustainable water infrastructure. Priority to systems serving < 300 connections and/or are disadvantaged.
- 10 hours of free Circuit Rider Technical Assistance (for populations <10,000)

To apply, eligible drinking water systems should prepare and submit information about their drinking water system and project(s) on our web-based Letter of Interest (LOI). For infrastructure projects, the LOI may be submitted year-round. Find more information about the LOI at http://www.orinfrastructure.org/LOI-Form/ and if you have questions about the LOI process, contact your Regional Coordinator at http://www.orinfrastructure.org/map.php.

Drinking Water Source Protection: Water systems may also qualify for loans up to $100,000 and for grants up to $30,000 for Drinking Water Source Protection (DWSP) efforts to help plan and implement activities that will protect the source of their drinking water. These types of projects have the same eligibility and application methods as described above, however these Letters of Interest are currently accepted on an annual basis.

The DWSRF program is jointly administered by the Oregon Health Authority's (OHA) Drinking Water Services and Business Oregon's Infrastructure Finance Authority (IFA). Contact the DWSRF Program Coordinator for more information at (971) 673-0422 or find more detailed information at the DWSRF Program webpage at http://healthoregon.org/srf.

3.9.7 – Industry Organizations & Resources

American Water Works Association (AWWA) Pacific Northwest Section
The northwest section of AWWA covers Oregon, Washington and Idaho. They offer training and networking opportunities for operators and utility managers.
http://www.pnws-awwa.org/

National Environmental Services Center (NESC)
This service center based in West Virginia produces materials through the Drinking Water Clearinghouse and offers assistance for small communities in the areas of drinking water and wastewater. Many free resources are available including "On Tap" magazine and others.
http://www.nesc.wvu.edu/

Oregon Association of Water Utilities (OAWU)
OAWU offers on-site assistance in many areas, including Safe Drinking Water Act and Clean Water Act regulations, water treatment technology, distribution system operation and maintenance, wastewater treatment and collections, and management issues such as rate structures and reviews, funding programs, budgeting and public relations. In addition, members receive the quarterly magazine, H2Oregon, legislative updates, and discounts on training seminars and annual meeting registration.
http://www.oawu.net/

Oregon Environmental Services Advisory Council (OESAC)
OESAC evaluates non-credit educational programs for continuing education and assigns continuing education units (CEUs) for water and wastewater and on-site operators. The web-site includes a list of approved courses.
http://www.oesac.com/

Rural Community Assistance Corporation (RCAC)
RCAC offers assistance to small, rural communities on housing and environmental issues. RCAC also manages a loan fund to support infrastructure and

community facility projects in rural areas. Within their environmental program, staff is available to work with communities on finance and budgeting, public outreach and education, project planning and development. Staff can also provide grant writing and other support services. http://www.rcac.org/

3.9.8 – State Certified Laboratories

All public water systems are required to get samples analyzed at a state certified laboratory. Below is the link to the state certified laboratory.

The list is continually updated. See the DWS website for the most updated list. http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Monitoring/Pages/labs.aspx

Oregon Health Authority

Drinking Water Services
Small Water System
Operator Designation Application

All parts of the application must be completed and signed by the owner if there is any change in ownership or the direct responsible charge. This form is to be completed every three years for renewal and within 30 days of any change of ownership or operator. Incomplete, unsigned or undated applications will not be accepted. Instructions start on page (3) three.

Reason for change: check all applicable boxes

☐ Change in water system name
☐ Change in owner/or authorized agent
☐ Change in Direct Responsible Charge information
☐ Update phone, address, email information
☐ Update contract information

Section A

PWS ID # 41-________________ County ____________________

PWS system name: ____

☐ Check if updating system name. Previous name: ______________________________

Are you renewing an existing certification? Yes ___ No ___

If yes, give expiration date: ___________

Section B

Owner: the owner (or authorized agent) is the person or entity that owns or is responsible for the public water system (e.g. mobile home park, private corporation, privately owned subdivision). The (authorized agent) may be the manager of mobile home park, one of the officers of the association, a school district officer or the principal and is the person directly appointed by the owner and must have been given the authority to act and sign all legal documents in the owner's behalf.

Owner (authorized agent) *(print)* Business Name

Name: _______________________________ _________________________________

Title:________________________________ Address: _________________________ Business

Phone:______________________ City: ________________ State:_______ Contact Phone:

______________________ Zip:_________

Email: ____

Signature: ___________________________________ **Date:**________________

<u>Section C</u>

Direct Responsible Charge (DRC): The DRC is the operator employed or contracted by the (owner) to run and oversee daily water distribution and treatment operations. The DRC must have either taken the program approved SWS training or be certified level D1-4 or T1-4, *The DRC may not sign for the owner unless DRC is also the owner (or co-owner) of the system.*

(Print) Name: ________________________ Address: _________________________
SS#: _________-_____-________ City: ______________ State: _________
Email: _____________________________ Zip: ___________
Business phone: ________________X _____ Phone: ___________________________
Signature: ____________________________ **Date:** ____________________________

<u>Class Training</u>: ☐ Date of class: _____________ Location of class: _____________ ☐ Online

Certified ☐ in WT or WD; Oregon Cert #:______ Level: ______ Contractor* Yes __ No ___
*Has the most current contract been submitted to the DWS in the past three years? Yes ___ No ___ *(A contract must be submitted every three years with this application)*

<u>Section D</u>

Additional Operator *(print)*
(Print) Name: ________________________ Address: _________________________
SS#: _________-_____-________ City: ______________ State: _________
Email: _____________________________ Zip: ___________
Business phone: ________________X _____ Phone: ___________________________
Signature: ____________________________ **Date:** ____________________________

Class Training: ☐ Date of class: __________ Location of class: ________ ☐ Online training

Certified ☐ in WT or WD: OR. Cert #_____ Level:_______ Contractor* Yes __ No __

<u>Section E</u>

Is the **contact information** for the SWS one of the above?
☐ Yes 1. Owner: ☐ 2. DRC: ☐
☐ No *(Complete information below)*
System Contact: *(Alternate)*
Name _______________________________ Title: ___________________
Address: _______________________________ City: __________________ State: _______
Zip:_______ Business Phone: ______________________
Signature: _______________________________ **Date**: _______________

When completed, **mail <u>original</u>** application to:

Oregon Health Authority
Drinking Water Services
PO Box 14450
Portland OR 97293-0450

For further information:

Website: http://healthoregon.org/dws
Or call Operator Certification: 971-673-0405

Instructions

Section A ***Name of System***

PWS: Print *or type* the name of the system and the system's ID number. You can look up your system ID# by going to (https://yourwater.oregon.gov/ click on data online and follow directions.

New or renew: Mark whether this application is for renewal.

Expiration date: Print or type the current or previous expiration date

Section B ***Owner***

Name: Print or type the name of the owner

Business: Print the place of business

Title: Print the title of the owner, (Manager of MHP, Principal, etc.)

Address: Print the mailing address

Phone Number: Print the phone number(s)

Email: Print the email address

Signature and date: The owner must sign and date this section B

Section C ***DRC***

Name: Print *or type* the name of the DRC.

SS# Print the DRC Social Security number *(see page 4)*

Address: Print the mailing address

Phone Number: Print the phone number(s)

Email: Print the email address

Signature and date: The DRC must sign and date this section C

Training: Check this box if you took the SWSTC training, write the date of class and location; or check the box if you took the training online.

Certified: Check this box if you are currently certified in Oregon, as a water distribution or water treatment operator. Include the certification # and level of certification.

Contract Check **yes or no** if the current signed contract has been submitted. Is the operator an employee or did you hire out for an operator? If there have been any changes in the system name, owner or operator a new contract must be submitted.

Section D ***Additional Operators***

Name: Print *or type* the name of the operator

SS# Print the SS# *(see page 4)*

Email: Print the email address

Address: Print the mailing address

Phone Number: Print the phone number

Signature and date: The operator must sign and date this section D

Training: Check the box if you took the SWSO training, write the class date and location or check the box if you took the training online.

Certified: Check the box if you are currently certified in Oregon as a water distribution or water treatment operator, include the certification # and level of Certification.

List additional operators by completing Section D only.

Section E ***Contact Information***

Check the correct box for contact information.
Print *or type* the alternate name of the person who is to be the contact person for the system and mark their affiliation with the system.

Mail Original signed and dated application

Legal Owner

The form must be signed by someone with authority to designate the operator on behalf of the system. An operator **cannot designate** themselves as being in direct responsible charge unless they are owners (or co-owners) of the system.

Depending on the type of system, that authority could reside with a number of persons. It could be the actual owner or, in the case of a homeowners association, one of the officers of the association. For a school, it could be a district officer or the principal of the school. For a workplace, it could be the general manager, or an officer of the company.

Rules: The operator certification rules can be found starting 333-061-0205

***Social Security Numbers*:**

State law requires you to provide your Social Security Number for any certification, license, or registration issued by the State of Oregon. Failure to provide your Social Security Number will be a basis to refuse to issue or renew the certification you seek. This record of your Social Security Number will be used for child support enforcement purposes and will not be used as a certification number on any certificate.

(Oregon Laws 1997, chapter 746, section 117 (ORS 25.785) and 42 USC § 666(a)(13))