**Operations & Maintenance (O&M) Manual**

Template produced by the

Arizona Department of Environmental Quality (ADEQ)

2018

Public Water System (PWS) Name

PWS Number

This Operations & Maintenance (O&M) manual template was created, in part, to assist water systems with the development of system specific O&M manuals. Depending on water system specifics, additional information and/or text will need to be added by the O&M manual developer. Once the final O&M manual is developed and in use, the document will need to be updated periodically to address any infrastructure, technical (including regulatory) and managerial changes.

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**Getting Started**

An Operations and Maintenance (O&M) manual for a water system facility describes:

* System characteristics
* Distribution systems including maintenance and sampling
* Startup procedures
* Emergency operations and response

This tool gives facility operators and managers instructions, log sheet samples and technical information for the efficient and safe operation of a facility during normal operations or during an unplanned or emergency situation. It may also be referenced by emergency responders for information like chemical storage and fire flow capabilities.

**Creating the O&M Manual**

This O&M manual template allows you to insert your system’s specific information into the text fields provided. It may also be printed and completed by hand.

The template contains two types of fillable fields: tables and fill-in-the-blank paragraphs.

1. Tables  
   The tables provide space for system characteristics. For example, when listing pumps in your system, the table has spaces for the pump location, size and capacity*.* Some of the tables will provide you with a list of options in a dropdown menu. Either type your answer into these fields, or select from the dropdown menu when available.
2. Fill-in-the-Blank Paragraphs  
   The template also includes fill-in-the-blank paragraphs making the narrative descriptions easy to complete. To complete one of these fields, click on the field and begin typing.

To complete the manual template, enter content into all the appropriate fillable fields.

To ensure your work is not lost along the way, please be sure to periodically save your document.

**System Characteristics**

The treatment process used in a public water system (PWS) depends on the source water used. Most systems have a multi-barrier approach that includes various units of operation.

**Groundwater System**

Groundwater’s quality is generally superior to surface water’s due to surface water’s turbidity and other pollutants. Groundwater treatment focuses on high mineral content: magnesium, manganese, and iron, along with dissolved gases. Arsenic and fluoride can also be a concern.

Treatment may include: air stripping, coagulation, ion exchange, chemical precipitation, membrane processes, disinfection, and absorption.

**Finished Water Storage**

**In- Situ (at-the-source) Post Extraction Treatment**

**Source Water**

**Disinfection**

The system may include the following treatments:

* Defluoridation
* Odor Taste Control
* Removal of Hardness

**Figure B. Groundwater System**

**Storage**

**Surface Water System**

Common surface water treatment includes: preliminary treatment, coagulation, flocculation, sedimentation, filtration, and disinfection.

*Preliminary Treatment* can be the screening of raw water with bar screens or wire-mesh to remove large debris. Preliminary treatment may include presedimentation, the removal of settleable solids, and the addition of chemicals.

*Coagulation* is the addition of chemicals which allow particles in a flash mix to clump together into heavier a nd larger pieces. The flash mix allows chemicals to distribute evenly by providing rapid agitation. Popular chemicals used in this process are Lime, Alum, Ferric Chloride, and Polyelectrolytes.

*Flocculation* is the process after the addition of coagulant chemicals in which particles “floc” or clump together. The mixing is very slow to prevent the break up of the “floc.”

**In-Situ (at the source) Post Extraction Treatment**

**Sedimentation**

**Flocculation**

**Coagulation**

**Chemical Flash Mix**

**Source Water**

**Filtration**

**Filtered Water Storage**

**Backwashing**

**Preliminary Treatment**

Fluoridation, Odor and Taste Control,

Removal of Hardness

**Disinfection**

*Sedimentation* is the 1- to 4-hour rest period in which suspended particles and flocs settle to the bottom of the tank. The settled solids are then handled through solids processing.

*Filtration* is the process whereby treated water is passed through a filter to remove any particles left after the sedimentation process. The filter retains the particles until a specific head loss is reached and then is periodically backwashed.

*Backwashing* is the process following filtration that is used to clean the filter.

*Disinfection* is the process which uses heat, ultraviolet radiation, or chemicals to kill or inactivate pathogenic organisms in water. This is not sterilization. Coliform bacteria is an indicator organism used in this process to measure the presence of pathogenic organisms.

*Filtered Water Storage* allows for uniform water distribution regardless of customer usage throughout the day.

Other common units include:

*In Situ Post Extraction Treatment* is treatment done at the water source by adding chemicals before the water enters the system.

*Fluoridation* is the addition of sodium fluoride, fluorosilicic acid, or sodium fluorosilicate. The addition is for the prevention of dental caries. The concentration of fluoride varies with regional temperature.

*Defluoridation* is the system used in PWSs where fluoride exceeds the allowed concentration. Packed beds of granular activated alumina are commonly used to remove fluoride.

*Odor/Taste Control* is a process in which chlorine, potassium permanganate, or activated carbon is used to control the taste and odor of the water.

*Corrosion Control* is the addition of lime, soda ash, caustic soda, metaphosphate or silicate to control water’s corrosive effects.

*Removal of Hardness* is done by softening the water through two methods: ion exchange and/or chemical addition. Hardness is commonly caused by calcium and magnesium.

**Narrative Description**

This section is a fill-in-the-blank document. If you are using an electronic template, then please review the questions which are highlighted between the paragraphs with information about your system. After you “TAB” to move around the document and add your information, the questions disappear and you are left with a completed document.

System Characteristics: Template Forms

* Contact Information and Permits
* Operator’s Information
* Geography and Maps
* Narrative Description
* Diagram of Treatment Process
* Summary Tables: Water Storage Tanks
* Summary Tables: Pressure System (Compressor)
* Summary Tables: Pump Stations

**System Characteristics**

Contact Information & Permits

**Contact Information**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of PWS: | | |  | | | | | | | | | |
| Type of System: | | |  | | | | Population | | | |  | |
| Physical Address: | | |  | | | | | | | | | |
| City: |  | | | State: |  | | | | Zip Code: | | |  | |
| Municipality: | |  | | | | County: | |  | | | | |
| Main Contact: | |  | | | | Telephone: | | | |  | | |
| E-Mail: | |  | | | | | | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Person Completing the Manual: |  | Date of Completion: |  |

**Permit & ID Information**

|  |  |
| --- | --- |
| Public Water System ID No. (AZ04-XX-XXX): | AZ04- |
| Well ID Number (from ADWR): |  |
| AZPDES ID No.: |  |
| Place ID: |  |
| Place Name: |  |
| Inventory Number: |  |
| APP Number: |  |

**System Characteristics**

Operator Information

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operator Name | Operator ID Number | Exp.  Date | Phone | Address | E-mail |
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**System Characteristics**

Geography and Maps

Water System

Geography near ***water system***:

Industry near ***water system***:

|  |  |  |
| --- | --- | --- |
| Commercial Retail | Food Service/Restaurant | Hospital |
| Agriculture | Manufacturing | Auto shop |
| Wastewater treatment plant | Other |  |

Geography near ***water source***:

Industry near ***water source***:

|  |  |  |
| --- | --- | --- |
| Commercial Retail | Food Service/Restaurant | Hospital |
| Agriculture | Manufacturing | Auto shop |
| Wastewater treatment plant | Other |  |

*Insert the following maps in the corresponding appendices of this document.*

Water system maps: Appendix 1  
Service area map: Appendix 2  
Source water assessment map: Appendix 3

**System Characteristics**

Narrative Description

**Raw Water Storage**  Raw storage does not apply

The raw storage tank is located at      .

The tank is made of       and has an elevation of       ft.

The riser pipe is       ft. wide. The holding capacity of the tank is       gallons.

The tank is generally operated at      %. The overflow pipe is located

and the drain connection is located

The air vent is located

      access hatches are located

Additional information:

**In Situ Treatment**  In Situ Post Extraction Treatment does not apply

Treatment at the water source is accomplished by applying       at the source. Common examples of chemicals used are a weak chlorine solution, oxidants or polyphosphates. The concentration used includes       (Example: Chemical X: 5 ppm)

The iron concentration in water should be       ppm prior to entering the system. The water pH should be       prior to entering the system.

Additional information:

**Aquatic Plant Control**  Aquatic Plant Control does not apply

The body of water treated has an alkalinity of       and is       ft. deep. The chemical used for aquatic control is

A dosage of       is applied every       (Example: Chemical: X: 5 ppm)

Additional information:

**Preliminary Treatment**  Preliminary Treatment does not apply

The preliminary treatment consists of

The preliminary treatment equipment is inspected every

Additional information:

**Coagulation**  Coagulation does not apply

Prior to entering the coagulation process the water’s normal conditions are:

* Temperature:
* Alkalinity:
* Turbidity:
* Suspended solids:

The chemical(s) and dosage used in the coagulation process include (example: Chemical: X: 5 ppm):

The coagulant aids used in the process include

These chemicals are stored in

and they are fed by a  feeder.

The type of feeder is best described as a .

Once the coagulants have been fed to the raw water, the combination goes into a mechanical flash mixer. The mixer used in this system is .

Additional information:

An example of a record document for this process is available in *Appendix 4: Coagulation-Flocculation Records.*

**Flocculation**  Flocculation does not apply

A  flocculator provides the appropriate detention time for flocs to form. The detention time required is       minutes. When leaving the flocculation basin, the water’s normal conditions are:

* pH:
* Turbidity:
* Filterability:

The coagulation/flocculation process is also monitored by the  and a normal reading is      .

At the end of the flocculation process, the residual coagulant measurement should be       mg/L.

Additional information:

An example of a record document for this process is in *Appendix 4: Coagulant-Flocculation Records*.

**Sedimentation**  Sedimentation does not apply

The treatment also includes sedimentation through a .

Normal influent turbidity is       and normal effluent turbidity is      . The turbidity is measured       times per day.

If the basin is working properly then the normal rate for weir overflow is       and surface overflow rate is      . The basins are inspected       times per year.

The usual amount of sludge that is pumped out of the basin is       per      . The sludge is disposed by      .

Additional information:

**Filtration**  Filtration does not apply

The filtration process uses a  filter.

A normal filtration process provides       hours of filter runs and a flow rate of       mgd. Normal observed head loss is       ft. A normal backwash water rate for this process is       gallons per minute. The volume of wash water generally used is      .

The backwash process generally takes       minutes. The backwash water is disposed by .

Additional information:

**Disinfection**   Disinfection does not apply

The treatment process or chemical used to get rid of disease-causing organisms is .

The disinfection application points are located      .

The chemical for treatment is in the  form and the concentration is      .

Information regarding routine monitoring requirements is in *Appendix 5: Disinfection Records.*

**Chlorination**  Chlorination does not apply

The form of chlorine used for water treatment is . The chemical compound used is  and the concentration is      .

The normal amount of contact time is       and the type of residual chlorine that is available after the required contact time is .

The normal temperature of the water source is      .

The pH of the water is checked every       and the normal range is       to      .

Interfering substances can cause the chlorine to become less effective. The normal turbidity level is      . Disinfectants are generally applied .

**Fluoridation**  Fluoridation does not apply

The addition of fluoride is intended to provide public health protection from dental decay or dental caries. Fluoride in water has been found to reduce tooth decay among children, but the uncontrolled concentration of fluoride can cause fluorosis. Fluoride concentration is based on the average air temperature. A drop of 0.3 mg/L below optimal concentration can reduce the benefits of fluoride while 1.5 over the optimal concentration can cause mottling of the teeth.

In this process, sodium fluoride, fluorosilicic acid or sodium fluorosilicate are fed through a .

The optimal concentration of fluoride is      .

Additional information:

**Defluoridation**   Defluoridation does not apply

Defluoridation is needed in a water system where water naturally exceeds the allowed fluoride concentration. The technique includes beds packed with granular activated alumina. The process includes treatment, backwash, regeneration and neutralization. Once the alumina beds have been used and their removal efficiency has depleted, a backwash is used to regenerate the removal efficiency of the bed. Once regenerated, these beds recover their removal capacity. Initially, the alumina beds will discharge a high pH and need to be neutralized with raw water. The beginning stage of the removal process is not as efficient as the late stages when the optimal pH is reached.

In this process, the allowed fluoride amount is

The optimal pH for removal is

**Backwash**  Backwash does not apply

The backwash lasts for       minutes.

The regeneration includes      % of NaOH at       gpm/ft2 for       minutes.

The process includes a second rinse at       gpm/ft2 for       minutes.

A second regeneration step includes      % of NaOH at       gpm/ft2 for       minutes.

The lowest measurement allowed in the process before a backwash is needed is

The backwash water is sent to:

Additional information:

**Finished Water Storage**  Finished Water Storage does not apply

When water is ready for consumption it is stored in a      -gallon tank located

The tank is elevated       ft. and is made of

The tank has a drain that can be opened by

**Hydropnuematic Tank(s)**  Hydropnuematic Tank(s) does not apply

      pumps within the system work with the tank(s) to maintain consistent pressure in the system.

The tank(s) operating range for ON/OFF pressure levels are       to

The tank(s) also aid(s) the water storage systems.

**Distribution Piping**

The piping material is made of

The structure is about       years old.

**Flow Rate**  Flow rate does not apply

The flow rate on a normal day is       gallons per day.

**System Characteristics**

Diagram of Treatment Process

Complete the diagram to reflect your water system’s treatment process.

|  |  |  |
| --- | --- | --- |
| Water source | Preliminary treatment screen | Pre-sedimentation |
|  |  | **Water Treatment** |
|  |  | Coagulation |
|  |  | Flocculation |
|  |  | Sedimentation |
| **Sludge Treatment** |  | Filtration |
| Solids handling treatment: | Disinfection type: | Tertiary treatment type: |
| Solids disposal type: |  | Storage tank distribution system |

**System Characteristics**

Summary Tables: Water Storage Tanks

Water Storage Tank Summary Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Tank name | Capacity (gallons) | Material | Location | Elevation (feet) | Overflow location | Drain valve location |
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Water Storage Tank Maintenance Summary Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Tank name | Operation (% of total capacity) | Total capacity (feet) | Operating level high (feet) | Operating level low (feet) | Manufacturer | Inspection frequency |
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For more information on tank inspection, see **Appendix 9**

**System Characteristics**

Summary Tables: Pressure System

Pressure System (Compressor) Summary Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| System Pressure ID or Name | Size | Location | Operating pressure PSI (on/off) | Frequency of replacing/cleaning filters for compressor | Lubrication frequency for compressor | Drain condensate frequency for compressor |
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**System Characteristics**

Summary Tables: Pump Stations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Pump station name | Number of hydropneumatic tanks/sizes | Number of pumps | Low/high pressure (PSI) | Location |
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**Distribution System**

Water is delivered to a community via a distribution system whose operator has two objectives:

1. To maintain water quality from the time water enters the distribution system to the “point of use” (the point of use refers to a point from where a user would access water, for example, a faucet or a sink); and
2. To maintain adequate pressure and flow to satisfy customers’ demands and to meet the needs of fire protection services.

An operator’s primary duty is to know the distribution system and be aware of possible sources and issues that would affect the quality of the water being delivered. Degraded water quality can be the result of issues at the source of the water supply (where water enters the distribution system), within the distribution system itself, or from outside sources.

**Water Quality**

Two main factors that affect water quality in the distribution system are water age and pipe corrosion.

*Water age* refers to the time that it takes the water to travel from the PWS to the customer’s tap. When water remains in the distribution system for too long, the disinfection chemicals can dilute and allow microorganisms to grow. Poor taste and odors can develop.

*Corrosion* of the distribution system piping can also affect water quality. Lead and copper levels can increase if water travels through corroded pipes or comes into contact with corroded fixtures. Both copper and lead are regulated under the EPA’s Lead and Copper Rule. A monitoring and flushing plan is essential for proper distribution system operation.

Contaminated water can enter the distribution system through cross connections and backflows. A quick review of the maintenance of the distribution system and cross connection prevention can be found later in the section “Maintenance and Prevention.”

Components of the Distribution System

Pipes, valves, meters, and pumps are just a few of the components of a distribution system. Knowing the location and function of each one of these parts is critical in properly maintaining the distribution system and preventing degradation of water quality.

**Pipe Materials**

*Ductile iron:* Made up of graphite cast iron with a lining made of cement mortar to prevent corrosion. These pipes are susceptible to corrosion.

*Concrete:* Concrete is favored for its extensive life, though connections are very difficult. It is available in larger diameters. Joints are typically sealed with an O-ring rubber gasket.

*Polyvinyl chloride (PVC):* Economical substitute for the ductile iron pipe. Lightweight and easy to handle and connect. Exposure to sunlight and petroleum products will cause damage to the pipe.

*Cast iron:* Tough and can withstand high pressures, but can be easily tapped.

*Asbestos cement (AC):* Composed of asbesotos fiber, silica sand, and cement. Pipe material will not burn, corrode, or deteriorate. AC is lightweight, easily tapped but has low bendable capacity.

*High density polyethylene (HDPE):* HDPE is flexible, lightweight, corrosion resistant, and can withstand various environmental conditions. Can also be utilized in various water applications.

**Valves**

*Gate valves:* Consist of discs controlled by turning the stem. They are moved downward into the water stream. When the gate reaches the bottom, a wedge engages and causes the gates to spread apart against the seat. By turning the stem in the opposite direction, the pressure is released and allows the gates to create distance from the seats. Gate valves are reliable and very low maintenance. Maintenance should consist of regular valve exercising.

Gate valve

*Check valves:* Used to control the flow from going backwards. Check valves have two openings: one for water to enter and the other for water to exit. The outer casing is made of plastic or metal.

Check valve

*Butterfly valves:* Consists of a disc with a rubber gasket on its sealing edge, which rotates in the stream from fully open to fully closed. Commonly used for flow regulation. Maintenance requires replacement of the rubber gasket.

*Pressure relief valves (PRV):* Used to relieve high-pressure surge conditions. The valve can be kept closed by a spring pushing against the valve disc. When there is a surge of high pressure, the spring releases and discharges the water pressure. As the pressure is lowered to normal, the spring forces the disc to close.

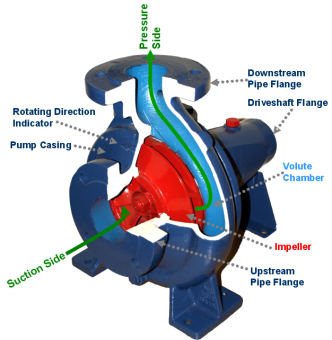
*Globe valves:* The valve is used to regulate flow in a pipeline. The body includes a baffle that separates the spherical body. The baffle has an opening that is closed and opened by a plug. This plug is controlled by the stem. Globe valves have high maintenance requirements.

Globe valve

*Surge anticipator valves (SAV):* An SAV is designed to minimize the effects of water hammer and pressure surges within the distribution system. When the pressure exceeds the setpoint, the valve opens quickly to dissipate the high-pressure surge.

*Altitude valve:* This valve controls the level of a water tank. The valve will close at a preset maximum water level to prevent overflow of a ground storage tank or reservoir. It will open to refill when the water level begins to decrease. The opening and closing of the valve is done automatically.

**Pumps**

*Centrifugal pumps:* These are the most common type of pumps used in the water system (see image below). These pumps use a rotating impeller to increase the pressure of the water. There are many sizes and configurations of centrifugal pumps to meet varying head and flow requirements.

**Impeller**

**Volute Casing**

**Bearing Housing**

**Pressure**

**Pump Casing**

**Suction Nozzle**

**Impeller Eye**

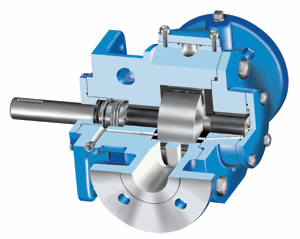
**Upstream Pipe Flange**

*Submersible pumps:* Mostly used for pumping groundwater from wells. This pump can be described as a multi-stage centrifugal pump. Most failures occur due to electrical problems with the motors.

*Vertical turbine pumps:* The water flows vertically through the channel with the impeller positioned in the center. The blades of the impeller are shaped so that the water flows in an outward direction. These pumps are relatively more expensive and require extra maintenance.

*Positive displacement pumps:* Commonly used for feeding chemicals (see image below). They displace a certain volume of water with each stroke of a piston or gear. More suited for high-pressure and low-flow service.

**Discharge Valve**



**Suction Valve**

**Packing**

**Piston**

**Meters**

*Displacement meter:* Commonly used in residential and small commercial applications. The water must physically shift the moving measuring element in direct relation to the amount of water that passes through the meter. The disc moves the magnet that drives the register.

*Multi-jet meter:* These meters are very accurate in small sizes and great for residential and smaller commercial uses. These meters use several ports that surround an internal chamber to create multiple jets of water against an impeller.

Turbine meter

*Turbine meter*: These meters are less accurate than displacement and jet meters at low flows. They are great meters for large commercial users, fire protection, and master meters for the distribution system.

*Compound meter:*  This type of meter is used for high-flow rates. These meters have two measuring elements and a check valve to regulate flow between them. When flows become too low for the turbine meter to read the flow accurately, a check valve closes to divert water to a smaller meter that can read the low flow accurately. The smaller meter is normally a multi-jet or positive displacement meter.



Compound meter

*Electromagnetic meter:* These meters use electromagnetic properties to determine the flow velocity. They require AC or DC electricity from a battery or line to operate the electromagnets. They can also read flow from both directions and use the electronics for measuring and totalizing the flow.

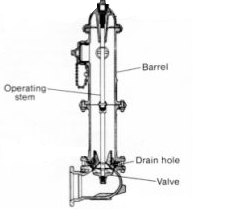
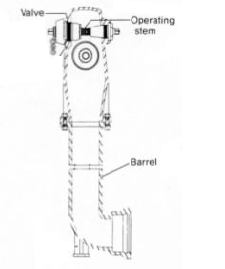
*Ultrasonic meter*: These meters use an ultrasonic transducer to send ultrasonic sound waves through the fluid to determine the velocity and measure the water volume.

**Hydrants**

In addition to firefighting, hydrants are also used for flushing the distribution system and providing high pressure to flush sewer lines. Hydrants may stir up sediment accumulated in the mains. The problem can be reduced by flushing the hydrants regularly. A flushing program can be set up to maintain hydrants, keep the system clean and prevent customer complaints.

*Dry hydrants* are generally used in freezing weather because the main valve is located under the frost line. Water is not present in the upper part of the stem. Valves located at the base drain leftover water into the ground once the hydrant has been used.

**Dry barrel hydrant Wet barrel hydrant**



Stem

Valve

Barrel

Stem

Barrel

Drain Hole

Valve

Maintenance and Prevention

Distribution system maintenance is essential in preventing the degradation of water quality as water travels through the system to reach customers. There should be a preventative maintenance program set up to ensure water quality and distribution system components are being properly maintained.

**Main Flushing**

Not all PWSs have problems with sediment accumulation, but those operators who find themselves with problematic systems establish a “flushing program.” Some PWSs combine their flushing program with their hydrant testing. Understanding the distribution system and responding to customer complaints will allow the operator to establish areas that need to be cleaned more often.

If an area needs to be flushed, it is recommended this be done at night or during low peak times when customers will be less affected by the process. It is also recommended that customers are informed of the flushing schedule and be advised to be aware of the water discoloration and possible issues that may result from flushing.

If a large system needs to be flushed, the conventional practice is to start from the plant and work outward. Hydrants should be used to “flush” out the water until it runs clear.

The unidirectional flush is a method in which all the valves to connecting mains are closed in one section. Then the section is flushed in one direction flushing at one hydrant at the end of the section.

**Cross Connection Control**

Cross connections are existing or potential connections between a potable and non-potable supply of water that can cause serious hazards for public health.

A cross connection can happen anywhere in a distribution system. Public places such as hospitals, businesses, and industries are more apt to contain cross connections.

Potential sources of cross connection locations:

* Dentist offices
* Car washes
* Funeral homes
* Boilers
* Cooling towers
* Printers
* Sinks
* Chlorinators
* Agricultural pesticide mixing tanks

If a cross connection is discovered, then according to R18-4-215, the PWS must: submit a written cross connection incident report to the department and the local health authority within five business days after a cross connection problem occurs that results in contamination of the public water system.

The report shall address all of the following:

1. Date and time of discovery of the unprotected cross connection
2. Nature of the cross connection problem
3. Affected area
4. Cause of the cross connection problem
5. Public health impact
6. A copy of any public health advisory issued (and related correspondence)
7. Each corrective action taken
8. Date of completion of each corrective action
9. Record retention - It is required that records of microbiological and turbidity analyses should be kept for no less than five years. Records of chemical analyses shall be kept for no less than 10 years. Records of action taken to correct any violation of regulations should be kept no less than three years after the correction action has been taken. Copies of written reports, summaries or communications shall be kept for no less than 10 years. Records concerning a variance or exemption shall be kept for no less than five years following the exemption or variance.
10. Backflow prevention assembly inspection should be done at least annually, or more often as directed by the water system or Department.
11. Distribution System: Template Forms

**Backflow Prevention**

Arizona has specific rules about backflow prevention. R18-4-215 provides specific information about the requirements for the PWS if and when a prevention device is needed. This section provides only a brief summary and it is recommended R18-4-215 be reviewed by the operator.

The PWS is responsible for ensuring that a backflow-prevention assembly is installed whenever any of the following occurs:

1. A substance harmful to human health is handled in a manner that could permit its entry into the public water system. These substances include chemicals, chemical or biological process waters, water from public water supplies that has deteriorated in sanitary quality, and water that has entered a fire sprinkler system. A Class 1 or Class 2 fire sprinkler system is exempt from the requirements of this Section;
2. A source of water supply exists on the user’s premises that is not accepted as an additional source by the public water system or is not approved by ADEQ.
3. An unprotected cross connection exists or a cross connection problem has previously occurred within a user’s premises; or
4. There is a significant possibility that a cross connection problem will occur and entry to the premises is restricted to the extent that cross connection inspections cannot be made with sufficient frequency or on sufficiently short notice to ensure that unprotected cross connections do not exist.

A brief description of the assemblies available for backflow prevention:

|  |  |
| --- | --- |
| **Backflow Prevention Assembly** | **Description** |
| Air Gaps | The air gap must be at least twice the internal diameter of the supply pipe, but not less than one inch.  There are no moving parts.  Surveillance is needed to check for tampering. |
| Reduced-Pressure (RP) Backflow Prevention Assembly | Made up of two spring-loaded check valves and a pressure regulated relief valve in between the check valves.  More trusted than Double Check Valves because the relief valve prevents leaks.  Must be installed where the relief port is not submerged, frozen, or vandalized. |
| Double Check Valves | No relief valve between the valves.  Because of leaks, this device is not recommended for situations in which health hazards may result. |
| Vacuum Breakers | Two types: atmospheric and pressure.  Used in piping connections where there is no back pressure. |
| Complete Isolation | Complete separation of conflicting pipes. Signs and Colors can be assigned to prevent any accidental connection. |

Once the backflow prevention has been set up, the PWS is responsible for maintaining records about the installation and the tests performed. These records shall be retained by the PWS for at least three years and shall be made available for review by the Department upon request.

These records shall include: An inventory of backflow-prevention assemblies and, for each assembly, all of the following information:

1. Assembly identification number and description
2. Location
3. Date of tests
4. Description of repairs and recommendations for repairs made by the tester
5. The tester’s name and certificate number

Sampling in the Distribution System

To ensure the quality of the water in the distribution system, the operator must sample the water in the distribution system. There are two ways an operator can get a water sample: grab sample and composite sample.

A *grab sample* is a certain volume of water collected at one point at one time. The sample represents only the quality of water at the time it was collected. If the analysis of the grab samples is observed to be uniform over a period of time, then the grab sample is representative of the quality of water.

A *composite sample* is a collection of grab samples collected at different times and mixed together. The analysis then provides the average value of all grab samples. A time composite sample refers to a composite sample where the same volume was taken at a specific time period. For example, a sample was taken every hour, every two hours or every 24 hours.

**Sample Locations**

Sample locations have two main requirements:

1. They have to be representative of the water source that enters the system; and
2. They must represent the various conditions within the distribution system.

The frequency of samples is determined by the number of customers served and the water source used. In some cases, samples will be taken from businesses and homes. If this is the case, then notifying the customer where the sampling will take place is appropriate.

**Collecting a Sample**

The point of collection becomes very important in the sampling process. It is advised to run the water for at least five minutes to allow stagnant water to flush out. A steady flow is desired to prevent any splashing. If a sampling point cannot provide a steady flow, then it should not be used.

The sample bottle is prepared with thiosulfate to stop the action of residual chlorine if chlorine disinfection is used. Therefore, it is very important that the sample bottle IS NOT rinsed prior to taking the sample. The sample bottle needs to be labeled properly with:

* Name of person sampling
* Time of sample
* Date of sample
* Location of sample (if the location is a customer’s house, provide address and specify location of the sink)
* Parameters (type of testing needed for the sample)

The sample bottle may be glass or plastic depending on the analysis requirements.

**Sample Holding Time**

Once the sample has been taken and labeled, it is important to be aware of the holding time of the sample. Depending on the analysis required, some samples will require certain tests to be done on-site such as temperature and pH.

Some bacteriological tests have a 24-hour holding time, meaning that the analysis needs to happen within 24 hours after the sample was collected to be valid. Due to the strict holding rules, it is advised that sampling be done mid-week to insure that a laboratory is available to receive the sample and analyze it within the appropriate timeframe.

Source Water Protection Area

The 1996 amendments to the federal Safe Drinking Water Act (SDWA) required states to develop and implement a Source Water Assessment Program (SWAP). Source Water Protection (SWP) is intended to be a proactive measure to protect our critical sources of public water supply. It focuses on pollution prevention practices to protect the water quality in a watershed or wellhead protection area serving a public water supply (i.e., the source water protection area).

Arizona’s Source Water Protection Program is designed to protect drinking water sources from becoming contaminated in the future. The program builds upon the [Wellhead Protection Program](http://www.azdeq.gov/environ/water/dw/download/welltxt.pdf), which was established by the Safe Drinking Water Act in 1986 and was designed to protect groundwater supplies being used to provide drinking water to the public through public water systems. The program provides a mechanism through which ADEQ and local communities throughout Arizona can protect both surface and groundwater drinking water sources.

ADEQ administers this program to assist public water systems, local officials, and utilities in developing and implementing plans to protect surface and groundwater resources by actively coordinating local pollution prevention efforts with existing state programs. Support available from ADEQ includes both assistance with program development and technical resources.

Distribution System: Template Forms

* Water Sources: Well(s)
* Water Sources: Surface Water
* Water Sources: Purchased Water
* Item Description: Valves
* Item Description: Fire Hydrants
* Item Description: Backflow Preventers
* Item Description: Pumps
* Item Description: Meters
* System Flushing
* Sampling

**Distribution System**

Water Sources: Well(s)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Well ID Number  (ADWR) | Permit Date | Diameter  (inches) | Well Depth  (feet) | Pump Capacity (gpm) | Casing Length (feet) | Casing Diameter (inches) | Casing Grouted (Yes or No) | Depth  of  Grout (ft.) |
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| Well ID Number (ADWR) | Well Driller | Installation Date | Well Location/Physical Address | GPS  Latitude/ Longitude |
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Water Sources: Surface Water

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| --- | --- | --- | --- | --- |
| Name | ID Permit Number | Date of Permit | Location Address or  GPS Latitude/Longitude | Allowance  Capacity (gpd) |
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Water Sources: Purchased Water

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| --- | --- | --- | --- | --- |
| Name of Supplier | Start Date of Contract | Contact Person | Telephone Number | Address |
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| --- | --- | --- | --- | --- | --- | --- |
| Name of Supplier | Pressure (psi) | Is water metered? (Yes/No) | Meter Size (inches) | Average Daily Usage (gpd) | Backflow Prevention  Yes/No | Additional Treatment Provided?  Yes/No |
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Item Description: Valves

The following table identifies valves in the distribution map including their locations, descriptions and functions.

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| --- | --- | --- | --- | --- | --- |
| Valve | Manufacturer/ Model Number | Location | Size (inches) | Description | Function |
| *Valve 001* | *EXAMPLE* | *Main St./1st Rd.* | *12”* | *Gate Valve* | *Shuts off all water to south of Main Street; Open 3rd in flushing routine.* |
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Item Description: Fire Hydrants

*Documents for recordkeeping can be found in Appendix 8: Hydrant Inspection Records.*

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| --- | --- | --- | --- | --- | --- | --- |
| Hydrant | Make/Model | Type | Location  (GPS if available) | Flow Capacity (gpm) | Inspection Frequency | Color |
| *EXAMPLE Hydrant 01* | *00000/00000* | *Dry Barrel* | *Intersection: 1st Ave. and 3rd St.* | *1500* | *1/year* | *Yellow* |
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Item Description: Backflow Preventers

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Manufacture | Model | Size | Serial Number | Last Test Date | Location | Tester Name | Certified Tester Number |
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Item Description: Pumps

*The following is a table that identifies pumps in the distribution map including their locations, size, and type.*

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Pump Name | Manufacturer/ Model Number | Pump Location | Flow Capacity (gpm) | RPM | Horsepower (HP) | Type of Pump | Lubrication/ Inspection Frequency |
| *Pump 1* | *EXAMPLE* | *Well # 3* | *50* | *100* | *25* | *Centrifugal* |  |
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Item Description: Meters

*The following table identifies meters in the distribution map including their locations, size and type.*

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| --- | --- | --- | --- | --- | --- | --- |
| Meter Name | Manufacturer/ Model Number | Meter Location | Pipe Size (in) | Flow Capacity (gal) | Inspection  Frequency | Description of Meter |
| *Meter 1* | *EXAMPLE* | *Well # 3* | *2”* | *55* |  | *Positive Displacement* |
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**Distribution System**

System Flushing

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| Location | Hydrant/Flushing Box Number | Flushing Volume (gpm) | Pressure Needed | Disinfection | Dechlorination  (Yes/No) |
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**Distribution System**

Sampling

*Sampling records are found in Appendix 8: Sampling Records*

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| --- | --- | --- | --- |
| Sample Type | Sample Location  (Address or GPS Coordinates) | Frequency | Sampling Procedure |
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**Start-Up Procedure**

Well-defined organization within a PWS is important in maintaining a high level of communication between management, operators, and decisionmakers. Proper organization requires that the jobs and duties of each staff member be defined and understood.

Organization Chart

An organization chart is an hierarchy designed to show the lines of authority in the organization. The chart shows who each manager is and who they manage.

Managing a PWS

A PWS is responsible for performing important tasks in order to maintain water quality standards. From maintenance tasks to monitoring tasks, a PWS manager must make sure each task is completed.

**Tasks**

Tasks are divided into two different types: monitoring and maintenance.

*Monitoring tasks* require the gathering of information about how the PWS units are working. Monitoring tasks include visual observations and sample analysis.

*Maintenance tasks* are either routine or necessary tasks. Maintenance tasks need to be completed when a monitoring task shows there is a problem in a *unit of treatment*. A unit of treatment refers to a specific part of the treatment, such as disinfection or sedimentation. For example, if the pH in the disinfection unit is abnormal, then a maintenance task needs to be performed to return the pH to normal.

Other times, maintenance tasks must be performed to prevent abnormalities in the system. For example, flushing in the distribution system rids the system of any settled solids in the pipes.

**Logs**

Because the completion of every task is important to maintain the quality of water, each employee must keep track of completed and incomplete tasks.

Logs are an easy way to set up a schedule and keep track of the completion date. Logs should include: a description of the task; the date task was completed; and the outcome of the task.

Logs can be categorized according to the frequency of the task. For example, does the task need to be completed daily, weekly, monthly, or yearly. Logs can also be categorized according to treatment units. For example: All chlorination tasks (daily, monthly, and yearly) are included in the chlorination log.

Logs are essential in understanding the PWS treatment process status. Logs are a tool used to track system operations and maintenance.

Logs are used to record normal settings in the process and report abnormal settings. *Normal settings* refer to the settings, such as temperature and pH, which are needed to achieve all compliance requirements.

Logs will also be used to collect information for reports to the decisionmakers of the organization. These decisionmakers can include managers, board members and community members.

**Work Orders**

Normal Observations/Logged



Worker’s

Task

Abnormality Observed/Logged

Maintenance Task

In Compliance

Normal Observations/Logged

Lo

In Compliance

Work orders are used by the manager to communicate, in writing, if any non-routine tasks are needed. Work orders are also used to record completed tasks by the staff for administrative purposes.

There are two parts of the work order: one for the manager and one for the person responsible for completing the task.

The manager’s section includes: (1) The task needing completion; (2) Work order date; (3) Date completed; (4) Location; (5) Instructions; and (6) Name of the person to complete the task.

The staff member responsible for the task should: (1) Include the hours needed to complete the task; (2) Identify the equipment and materials used; (3) Return the form to the manager once the task is completed.

**Lab Records**

Lab records are very important when it comes to showing compliance with the ADEQ’s Safe Water Regulations. Lab records include:

* Refrigerator Temperature Log
* Sample Analysis Records
* Laboratory Equipment Maintenance Log
* Chain of Custody
* Conductivity Probe Calibration Log
* Bench Sheets

All of these logs allow for recording different information, but all have the same goal: to record every step and detail of sample handling and sample analysis. If it is not recorded then, as far as an inspector is concerned, it never happened.

|  |  |
| --- | --- |
| **Lab Record Type** | **Characteristics** |
| Refrigerator Temperature Log | * Used to record the temperature of the refrigerator to assure correct holding temperature for samples. * Includes a space for the date, the name of the technician performing temperature inspection and the temperature observed. * Includes a space to record the first and last day the log was used. |
| Sample Analysis Records | * Provide information such as the analysis name, date, and the name of the person performing the analysis. * If data was entered into a record system, then the form should include the names and signatures of the person who entered the data and the person who approved the entered data. * Includes information such as the reference sample concentration by calculation and the reference sample concentration by analysis. |
| Laboratory Equipment Maintenance Log | The log should include: date, name of technician, maintenance activity, reason for maintenance and a space for notes. |
| Chain of Custody | * *Extremely important* for any water treatment sampling procedure. * Keeps track of every person that has handled the sample. * Contains space for the signature of the person who took the sample, and about four more spaces for the signatures of anyone who handled the sample after it was taken. * Contains: date of the sample, time, identification, container type, sample type and preservation information. |
| Conductivity Calibration Log | This form contains the date, name of analyst, reading before calibration, slope, reading after calibration and notes. |
| Bench Sheets | * Keeps track of the analysis of the sample: sample date, time, location and type. * Includes the names of the person who collected the sample and the analyst; analysis date and time; name and information of the equipment used. * *Example:* if an oven was used, then the record should include time in the oven, time out of the oven and oven temperature at the time sample was taken out. It should also include a description of the EPA method used. |

*Examples of Logs, Work Orders, Chain of Custody and Inspection Forms are included in the Appendices.*

Safety

Safety is a crucial component of the work tasks in a PWS. Safety is regulated by the Occupational Safety and Health Administration (OSHA) at the federal level and the Arizona Division of Occupational Safety and Health at the state level.

Safety is both a responsibility and a right. Workers have a right to a safe work environment, therefore, PWS management should develop a safety program that trains the PWS staff in the proper safety procedures when working in the PWS. PWS staff likewise have the responsibility to perform tasks in accordance with the established safety procedures. A part of such a safety plan is the duty to report all observed hazards and injuries.

**Electrical Equipment**

A PWS worker is at risk of electrocution or shock because of the damp conditions they work in while using electrical equipment. To avoid accidents:

* Protect electrical equipment and wiring from deterioration.
* Be aware of wet areas nearby.
* Cover any live parts with fittings or enclosures to prevent contact.
* Only permit-qualified individuals should be allowed to work with PWS electrical equipment.
* Install ground fault interrupter where needed.
* Follow *Lock out/Tag out Procedures* (on the next page) to clean, service or adjust an electrical device.

**Pumps**

The danger of pumps derives from their moving parts. Pumps may include rotating and cross motions and back-and-forth movement. To reduce the risk of injury, pumps have many of their moving parts covered.

Safety procedures for pumps should be followed during the performance of any maintenance. If a pump needs to be manually fixed or inspected, then there are two main procedures to follow:

* Identify all potential hazards prior to starting.
* Follow *Lock out/Tag out Procedures* (on the next page).

If possible, all personnel not working on the pump should leave the area until the work is done.

|  |  |
| --- | --- |
| **BASIC LOCK OUT/TAG OUT** | |
| **Communicate** | Communicate to all affected PWS staff about why the unit is being locked. |
| **Shut off Unit** | Isolate the equipment’s energy source. The source may be controlled by a switch or a valve. |
| **Check For Store Energy and Pressure** | Energy may be stored in springs, hydraulic systems, and rotating parts.  Pressure for steam, gas, air, or water should be restrained or dissipated. |
| **Lock out/ Tag out** | Make sure no one is in the unit or close to it.  Using an appropriate labeled tag, isolate the energy from the unit. *See image following this table.*  Check that the unit has no energy by turning or pressing the “on” setting. The “on” setting should have been disabled and no parts should move. |
| **Completed Work** | Once the work or task is completed in the unit:   * Make sure no one is left in the unit. * Make sure all tools are cleared. * Remove “lock out/tag out” lock. * Enable energy. * Notify affected employees the task is done. |

**Properly labeled tag**

Tag out devices shall warn against hazardous conditions if the machine or equipment is energized and shall include one of the following:

* ***Do Not Start.***
* ***Do Not Open.***
* ***Do Not Close.***
* ***Do Not Energize.***
* ***Do Not Operate.***

**Time off: \_\_\_\_\_\_\_  
Date: \_\_\_\_\_\_\_\_\_**

**Approximate Completion Time:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Signature: \_\_\_\_\_\_\_\_\_**

***Only this person authorized to   
remove this tag***

**Water Storage**

Water storage can be especially dangerous during the application of interior coating and inspections of wetwells and treatment basins. This maintenance task requires confined space entry safety procedures.

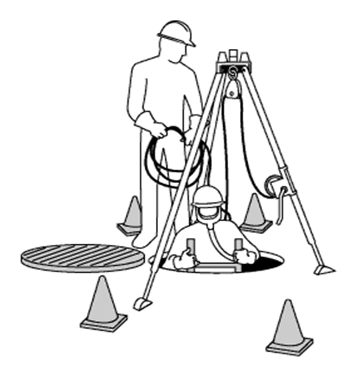
Confined space is described as a place:

* That is not designed for continuous use or occupancy.
* Has restricted exit and entry.
* Is large enough that an employee can performed assigned work.
* May contain a hazardous environment.
* May contain material that may incapacitate the individual entering.
* May trap or asphyxiate entrant.
* Has been observed to cause hazards to the safety of the individual entering.

Under federal regulations a confined space may or may not require a permit. Non-permit-required confined spaces must be considered a permit-required confined space until a competent person has followed pre-entry procedures and determined the space does not require a permit.

A competent person is defined as an individual who can evaluate and recognize hazards. This person must know how to follow proper procedures to ensure worker safety.

*A sample confined entry permit check list is provided in Appendix 11.*



**Storage Tank**

**Attendant monitors air for Oxygen, LEL and Carbon Monoxide**

**Personal Protective  
 Equipment (PPE)**

**Lifeline to Safety Harness**

**Chlorine**

Chlorine is highly corrosive and toxic in moist environments. Chlorine can be handled as a gas, liquid, or dry form. Because chlorine is highly corrosive when moist, it should be handled in corrosive-resistant containers such as glass, silver, or Teflon. But if chlorine is in gas form, it should be handled in steel containers because of the gas’s high pressure.

Chlorine is dangerous because it can disable a person’s sense of smell.

Chlorine can be detected by a person at .3 ppm. A person should never be exposed to any concentrations of 1 ppm or more. Chlorine exposure in small amounts can cause vomiting, heavy coughing, and severe irritation of the nose, mouth, eyes, and lungs. Heavy exposure to chlorine can be fatal.

When working around chlorine, the following personal protective equipment (PPE) should be used:

* Self-contained breathing apparatus
* Boots
* Gloves
* Disposable suits with hoods
* If concentration is high then a chemical suit is appropriate

**Other Chemicals**

Chemicals have different dangers at different levels of exposure. The PWS staff should be familiar with the chemical prior to working with it. Therefore, it is important to maintain Safety Data Sheets (SDS) for all chemicals handled in the PWS. An SDS contains information necessary to familiarize the PWS staff with the chemicals located in their place of work.

*Example: Components of a Safety Data Sheet*

Product identification Sodium Hypochlorite

Figure A Composition 12.52% - 15.6%

Hazards and effects Severe irritation and burning

First aid Flush with water. Do not induce vomiting

Firefighting measures Water, foam or dry chemical

Accidental release Flush with water. Use absorbent material

Neutralizing agent Sodium Bisulfite

Handling and storage Cool / dark not to exceed 100 F

Reactive data Ammonia

PPE required Gloves, goggles

Disposal In accordance with local, State, and Federal regulations

Startup Procedure: Template Forms

* PWS Staff Organization Chart
* PWS Staff Task Descriptions
* Inspection of the Distribution Facility
* Routine Tasks
* Routine Monthly Tasks
* Routine Quarterly Tasks
* Routine Semiannual Tasks
* Routine Annual Tasks
* Other Routine Tasks

Startup Procedure

**PWS Staff Organization Chart**

**Organization Name:**



**2.**

**3.**

**4.**

**5.**

**6.**

Startup Procedure

**PWS Staff Task Descriptions**

|  |  |  |
| --- | --- | --- |
| **Name** | **Job Title** | **Task Descriptions** |
|  |  |  |
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**Startup Procedure**

**Inspection of the Distribution Facility**

|  |  |  |  |
| --- | --- | --- | --- |
| **Task** | **Frequency** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
| Well Number or ID |  |  |  |
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|  |  |  |  |
| Storage Tank |  |  |  |
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| Pumps |  |  |  |
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| Hydrants |  |  |  |
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| --- | --- | --- | --- |
| **Task** | **Frequency** | **Expected Result** | **Troubleshooting in Case of**  **Unexpected Result** |
| Pipe Number or ID |  |  |  |
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Startup Procedure

**Routine Daily Tasks**

|  |  |  |
| --- | --- | --- |
| **DAILY** | | |
| **Task** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
| Well |  |  |
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|  |  |  |
|  |  |  |
| Disinfection |  |  |
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| Distribution System |  |  |
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| --- | --- | --- |
| **DAILY** | | |
| **Task** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
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**Routine Daily Tasks**

**Routine Monthly Tasks**

|  |  |  |
| --- | --- | --- |
|  | **MONTHLY** |  |
| **Task** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
| Record Monthly Source Water Production (daily, if introducing chemicals) |  |  |
|  |  |  |
| Date of Submission of Monthly Report to Water Supply Division |  |  |
|  |  |  |
| Chemical Solution Tanks Filled |  |  |
|  |  |  |
| CollectTests of Chemical Feed Pump |  |  |
|  |  |  |
| Calibrate all Analysis Equipment/Replace Fluids as Necessary/Clean and Flush as Needed |  |  |
|  |  |  |
| System Maintenance |  |  |
| Pumps |  |  |
| Valves |  |  |

**Routine Monthly Tasks**

|  |  |  |
| --- | --- | --- |
| **MONTHLY** | | |
| **Task** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
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**Routine Quarterly Tasks**

|  |  |  |
| --- | --- | --- |
| **QUARTERLY** | | |
| **Task** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
| Collect Required Chemical Monitoring Samples |  |  |
|  |  |  |
| Calibrate All Analysis Equipment |  |  |
| pH meter |  |  |
| Turbidity meter |  |  |
|  |  |  |
| Collect Bacteriological Sample for ADEQ Compliance |  |  |
| Collect Nitrate Sample for ADEQ Compliance |  |  |
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**Routine Semiannual Tasks**

|  |  |  |
| --- | --- | --- |
| **SEMIANNUAL** | | |
| **Task** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
| Inspect Surface Water Intake |  |  |
|  |  |  |
| Calibrate All Analysis Equipment |  |  |
| pH meter |  |  |
| Turbidity meter |  |  |
|  |  |  |
| Inspection of Fire Hydrants (Appendix 8: Hydrant Inspection Records) |  |  |
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**Routine Annual Tasks**

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| --- | --- | --- |
| **ANNUAL** | | |
| **Task** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
| Exercise All Valves in Distribution System |  |  |
|  |  |  |
| Calibrate All Analysis Equipment |  |  |
| pH meter |  |  |
| Turbidity meter |  |  |
|  |  |  |
| Anti-Siphon and Backflow Prevention Assembly Testing |  |  |
|  |  |  |
| Flush Distribution System (unidirectional) |  |  |
|  |  |  |
| Prepare/Distribute Consumer Confidence Report |  |  |
|  |  |  |
| Collect Bacteriological Sample for ADEQ Compliance |  |  |
| Collect Nitrate Sample for ADEQ Compliance |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Other Routine Tasks**

|  |  |  |  |
| --- | --- | --- | --- |
| **OTHER** | | | |
| **Task** | **Frequency** | **Expected Result** | **Troubleshooting in Case of Unexpected Result** |
| Inspect and Clean Storage Tank | Every 5 years |  |  |
|  |  |  |  |
| Update Monitoring Waivers | Every 3 years |  |  |
|  |  |  |  |
| Apply and Renew Permit to Operate | Based on Permit Expiration Date |  |  |
|  |  |  |  |
| Renew Certified Operator Certification | Every 3 years |  |  |
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**Emergency Operations Plan / Emergency Response Plan**

A PWS must be ready for any emergency situation that might arise from contamination or loss of the water supply. PWS staff must be trained to implement the proper procedures for using an alternative water supply source(s).

An Emergency Operations Plan/Emergency Response Plan must meet the requirements of the Arizona Department of Environmental Quality, Drinking Water Program Title 18, Chapter 4, Article 204 of the Arizona Administrative Code and the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL107-188, referred to as the Bioterrorism Act). In the Bioterrorism Act, Congress recognized the need for drinking water systems to undertake a more comprehensive view of water safety and security. The Act amends the Safe Drinking Water Act and specifies actions community water systems and the U.S. Environmental Protection Agency must take to improve the security of the Nation’s drinking water infrastructure.

An Emergency Operations Plan/Emergency Response Plan includes:

* Flow Information
* Emergency Contact List
* Staff Contact List
* Emergency Disinfection Procedures
* Lists of procedures to deal with different scenarios such as water source contamination and loss of water supply.

Once completed, the plan should be updated regularly and the staff should be informed of any changes to the plan.

Public Notification

When a PWS is not in compliance with sampling requirements for fecal coliform or nitrate, or a waterborne disease outbreak jeopardizes the health of the community, then the community needs to be notified immediately.

*The notice needs to communicate various points to the community as required by the ADEQ and the EPA.*

The notice must include:

* PWS Name, ID#, and Date of Distribution.
* What kind of warning the notice is conveying.
* What the warning means to the community. For example, what kind of effects might the contamination have on public health?
* What steps the community should take to prevent health problems.
* What part of the population in the community will be most affected. (Generally, infants are the most affected population in the community.)
* Explain what the PWS is doing to correct this problem.
* Expected date of correction.
* Contact number: where the community can call for questions. The person(s) at this number should be aware of the issue and be prepared to communicate to the community in a professional manner.
* Request for the information to be shared with others.

Public notification also includes communicating with the media.

Emergency Operations Plan/Emergency Response Plan:   
Template Forms

* PWS Overview
* Local Emergency Responders
* Staff Contact List
* Maps
* Loss of a Source
* Provision of Alternative Sources of Water During Emergency
* Critical Part Inventory List: Prevention of Loss of Water Supply Due to Major Component Failure
* Critical System Components
* Procedure Description: Critical System Failure
* Damage of Power Supply Equipment/Loss of Power
* Distribution System Emergency Disinfection Procedure
* Water Source Emergency Disinfection Procedure
* Emergency Isolation List
* Contamination of Water in the Distribution System from Backflow
* Collapse of Reservoir, Reservoir Roof, or Pump House Structure
* A Break in a Transmission or Distribution Line
* Notice Procedures
* Disinfection and Testing of Distribution System
* Sequenced System Shutdown

Emergency Operations Plan/Emergency Response Plan

**PWS Overview**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PWS Characteristics | | | | | | | | |
| Name of the PWS: | | |  | | | | | |
| Population Served: | | |  | | | | | |
| Number of Service Connections | | |  | | | | | |
| Type of System | | |  | | | | | |
| Average Daily Demands | | | gal/day | | | | | |
| Design Capacity | | | gal/day | | | | | |
| # of Wells/Water Source | |  | | # of Storage Tanks |  | | # of Pressure Tanks |  |
| Laboratories | | | | | | | | |
| LAB |  | | | Contact |  | | Phone |  |
| LAB |  | | | Contact |  | | Phone |  |
| PWS Water Source(s) | | | | | | | | |
|  | | | | | | | | |
| Water Source | | | Water Source ID # | | | Connection Location | | |
|  | | |  | | |  | | |
|  | | |  | | |  | | |
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|  |  |  |  |
| --- | --- | --- | --- |
| Date Completed |  | Completed by: |  |

**Local Emergency Responders**

|  |  |  |
| --- | --- | --- |
| **Name and Title** | **Phone No.** | **Cell/Pager No.** |
| *General Emergency Assistance* | *911* | *N/A* |
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**Staff Contact List**

|  |  |  |
| --- | --- | --- |
| **Name and Title** | **Phone No.** | **Cell/Pager No.** |
| *PWS Manager* |  |  |
| *PWS Certified Operator* |  |  |
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**Maps**

Maps for this system can be found in:

Appendix 1: Water System Maps

1. Water System Schematic
2. As-Built Map of the Water System

Appendix 2: Service Area Map

Appendix 3: Source Water Assessment Map

**Loss of a Source** (R18-4-204) A1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Loss of a Source** | | | | | | |
| **Contacts** | | | | | | |
| **1st PWS Staff Contact** | |  | | **Phone** | |  |
| **2nd PWS Staff Contact** | |  | | **Phone** | |  |
| **Backup Water Source** | | | | | | |
| **Type** | **Name** | | **Location** | | **Contact** | |
|  |  | |  | |  | |
|  |  | |  | |  | |
| **Procedure Steps** | | | | | | |
|  | | | | | | |

**Provision of Alternate Sources of Water During Emergency** (R18-4-204) B1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Provision of Alternate Sources of Water During Emergency** | | | | | | |
| **Contacts** | | | | | | |
| 1st PWS Staff Contact | |  | | Phone | |  |
| 2nd PWS Staff Contact | |  | | Phone | |  |
| **Backup Water Source** | | | | | | |
| **Type** | **Name** | | **Location** | | **Contact** | |
|  |  | |  | |  | |
|  |  | |  | |  | |
| **Procedure Steps** | | | | | | |
|  | | | | | | |

**Critical Part Inventory List**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Critical Parts** | | | | |
| **Critical Part** | **Location** | **In-stock/Location** | **Supplier** | **Supplier Contact Number** |
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**Critical System Components** (R18-4-204) B4

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| --- | --- | --- | --- | --- | --- |
| **Critical System Components** | | | | | |
| **Critical System Unit** | **Connected to critical water user?** | **Critical Water User** | **Location of Connection** | **Critical Water User Contact Name** | **Critical Water User Contact Phone** |
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**Procedure Description: Critical System Failure** (R18-4-204) B4

|  |  |  |  |
| --- | --- | --- | --- |
| **Procedure Description: Critical System Failure** | | | |
| **Contact** | | | |
| **1st Contact** |  | **Phone** |  |
| **2nd Contact** |  | **Phone** |  |
| **3rd  Contact** |  | **Phone** |  |
| **Procedure Steps** | | | |
|  | | | |

**Damage of Power Supply Equipment/Loss of Power** (R18-4-204) A3

|  |  |  |  |
| --- | --- | --- | --- |
| **Procedure Description: Damage of Power Supply Equipment/Loss of Power** | | | |
| **Contact** | | | |
| **1st Contact** |  | **Phone** |  |
| **2nd Contact** |  | **Phone** |  |
| **3rd  Contact** |  | **Phone** |  |
| **Primary Electrician** |  | **Phone** |  |
| **Backup Electrician** |  | **Phone** |  |
| **Generators** | | | |
| **Number of Generators** |  | | |
| **Location of Generator(s)** |  | | |
| **Procedure Steps** | | | |
|  | | | |

**Distribution System Emergency Disinfection Procedure** (R18-4-204) A4, A6, B3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Contacts** | | | | | | | | |
| **1st Contact** | |  | | | **Phone** | |  | |
| **2nd Contact** | |  | | | **Phone** | |  | |
| **3rd Contact** | |  | | | **Phone** | |  | |
| **Chemicals** | | | | | | | | |
| **Chemical** |  | | **In-stock Location** |  | | **Chemical Supplier/Phone** | |  |
|  | | | | | | | | |
| **Steps for Emergency Disinfection Procedure** | | | | | | | | |
|  | | | | | | | | |

**Water Source Emergency Disinfection Procedure** (R18-4-204) B7

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Contacts** | | | | | | | | |
| **1st Contact** | |  | | | **Phone** | |  | |
| **2nd Contact** | |  | | | **Phone** | |  | |
| **3rd Contact** | |  | | | **Phone** | |  | |
| **Chemicals** | | | | | | | | |
| **Chemical** |  | | **In-stock Location** |  | | **Chemical Supplier/Phone** | |  |
|  | | | | | | | | |
| **Steps for Emergency Disinfection Procedure** | | | | | | | | |
|  | | | | | | | | |

**Emergency Isolation List** (R18-4-204) A4, A7, B3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Isolation Mechanism | Isolation Mechanism Location (Address/GPS) | Isolation Area Beginning (Address/GPS) | Isolation Area Ending (Address/GPS) | Critical User In Isolation Area |
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Contamination of the Distribution System from Backflow Incident (R18-4-204) A4

|  |  |  |  |
| --- | --- | --- | --- |
| **Procedure Description: Contamination of the Distribution System from Backflow Incident** | | | |
| **Contact** | | | |
| **1st Contact** |  | **Phone** |  |
| **2nd Contact** |  | **Phone** |  |
| **3rd  Contact** |  | **Phone** |  |
| **Backflow/Cross Connection Specialist** |  | **Phone** |  |
| **Procedure Steps** | | | |
| *1. First, contact appropriate staff and regulatory agencies.*  *2. Second, review Emergency Area Isolation List.*  *3. Third, review Emergency Disinfection Procedure.*  *4. Fourth, review media/community notification procedures.* | | | |

**Collapse of Reservoir, Reservoir Roof or Pump House Structure** (R18-4-204) A5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Procedure Description: Collapse of Structure** | | | | |
| **Contact** | | | | |
| **1st Contact** |  | | **Phone** |  |
| **2nd Contact** |  | | **Phone** |  |
| **3rd  Contact** |  | | **Phone** |  |
| **Heavy Equipment** | | | | |
| Heavy Equipment Provider | | Phone | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
| Onsite Heavy Equipment Name | | Location | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
| **Procedure Steps** | | | | |
| 1. *Contact appropriate staff and regulatory agencies.* | | | | |

**Break in a Transmission or Distribution Line** (R18-4-204) A6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Procedure Description: Break in a Transmission/Distribution Line** | | | | |
| **Contact** | | | | |
| **1st Contact** |  | | **Phone** |  |
| **2nd Contact** |  | | **Phone** |  |
| **3rd  Contact** |  | | **Phone** |  |
| **HEAVY EQUIPMENT** | | | | |
| Heavy Equipment Provider | | Phone | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
| Onsite Heavy Equipment Name | | Location | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
| **Procedure Steps** | | | | |
| *1. First, contact appropriate staff and regulatory agencies.*  *2. Second, check if area can be isolated.* | | | | |

**Notice Procedures** (R18-4-204) B2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Procedure Description: Public Notice** | | | | |
| **PWS Contact** | | | | |
| **PWS Public Relations/Media Specialist** |  | | **Phone** |  |
| **1st Contact** |  | | **Phone** |  |
| **2nd Contact** |  | | **Phone** |  |
| **Regulatory Agencies** | | | | |
| Regulatory Agency Name | | Phone | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
| **Newspapers** | | | | |
| Newspaper Name | | Phone | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
| **News Channels** | | | | |
| News Channel Name | | Phone | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
|  | |  | | |
| **Topics to Convey to the Public** | | | | |
|  | | | | |

**Disinfection and Testing of the Distribution System Once Restored** (R18-4-204) B3

|  |  |
| --- | --- |
| **Disinfection and Testing of the Distribution System Once System is Restored** | |
| **Contact** | |
| PWS Disinfection Manager |  |
| LAB |  |
| **Procedures for Disinfection Testing after Resoration** | |
|  | |

**Sequenced System Shutdown**

Shutdown of the water distribution system may become necessary due to the risk of contamination, natural disasters or other unsafe conditions. The main objective of any plant/system shutdown is to avoid damage or unstable operating conditions resulting from system shutdowns or valve operations. It is the responsibility of the operator to ensure that the proper procedures are carried out in accordance with reliable operating practices. Below are key factors to keep in mind while developing your shutdown procedures:

* Actions by consumers may affect the hydraulic condition within the water distribution system
* Actions by the operator may influence conditions within the consumer’s systems
* Ensure that the temporary pressure generated by a shutdown or valve operations within the pipelines and other equipment is not detrimental to system.

|  |  |  |  |
| --- | --- | --- | --- |
| **Sequenced System Shutdown** | | | |
| **Contact** | | | |
| **1st Contact** |  | **Phone** |  |
| **2nd Contact** |  | **Phone** |  |
| **3rd  Contact** |  | **Phone** |  |
| **Steps to Ensure Proper System Shutdown** | | | |
|  | | | |

**Appendices**

|  |  |  |
| --- | --- | --- |
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|  |  |  |

**Appendix 1: Water System Map**

Provide a map for the following:

1. Water system schematic
2. As-built map of the water system

**Appendix 2: Service Area Map**

Provide a map of the service area.

**Appendix 3: Source Water Assessment Map**

Provide a map of the source water assessment.

**Appendix 4: Coagulation-Flocculation Records**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Start Date: End Date: | | | | | | | | | | | |
| Type of Coagulant: | | | | | | | | | | | |
| Date this record started: | | | | | | | | | | | |
| **Item** | **Expected Result** | **Result/Date** | | | | | | | | | |
|  |  |  |  | |  | |  |  |  |  |  |
| Coagulant Dosage |  |  |  | |  | |  |  |  |  |  |
| **Raw Water** |  | | | | | | | | | | |
| Temperature (°C) |  |  | |  | |  |  |  |  |  |  |
| pH |  |  | |  | |  |  |  |  |  |  |
| Alkalinity (mg/L as CaCo3) |  |  | |  | |  |  |  |  |  |  |
| Turbidity |  |  | |  | |  |  |  |  |  |  |
| Taste and Odor |  |  | |  | |  |  |  |  |  |  |
| Color |  |  | |  | |  |  |  |  |  |  |
| Suspended Solids (mg/L) |  |  | |  | |  |  |  |  |  |  |
| Algae Content |  |  | |  | |  |  |  |  |  |  |
| **Coagulated Water** |  | | | | | | | | | | |
| Filterability (Volume/Time) |  |  | |  | |  |  |  |  |  |  |
| Zeta Potential (mV) |  |  | |  | |  |  |  |  |  |  |
| Settled-Water Turbidity |  |  | |  | |  |  |  |  |  |  |
| **Filtered Water** |  | | | | | | | | | | |
| Turbidity |  |  | |  | |  |  |  |  |  |  |
| Color |  |  | |  | |  |  |  |  |  |  |
| Taste and Odor |  |  | |  | |  |  |  |  |  |  |
| Algae Content |  |  | |  | |  |  |  |  |  |  |
| Residual Coagulant (mg/L) |  |  | |  | |  |  |  |  |  |  |

**Appendix 5: Disinfection Records**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Start Date: End Date: | | | | | | | | | | | | | | | | | | |
| Name of Chemical: | | | | | | | | | | | | | | | | | | |
| Strength of Chemical (%): | | | | | | | | | | | | | | | | | | |
| Form (Liquid, Power, or Gas) | | | | | | | | | | | | | | | | | | |
| Size of Container (Gallons or Lbs.) | | | | | | | | | | | | | | | | | | |
| Supplier: | | | | | | | | | | | | | | | | | | |
| Supplier’s Phone: | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| **ITEM** | **EXPECTED RESULT** | **RESULT/DATE** | | | | | | | | | | | | | | | | |
|  |  | **Example**  **00/00/00** | |  | |  | |  | |  | |  | |  | |  | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |
| Raw Water |  | | | | | | | | | | | | | | | | | |
| pH |  | **0** |  | |  | |  | |  | |  | |  | |  | |  |
| Chemical |  | | | | | | | | | | | | | | | | | |
| Dosage (mg/L) |  | **0** | |  | |  | |  | |  | |  | |  | |  | |
| Tests |  | | | | | | | | | | | | | | | | | |
| Bacteriological Results |  | **0** | |  | |  | |  | |  | |  | |  | |  | |
| Residual Results |  | **0** | |  | |  | |  | |  | |  | |  | |  | |

**Chemical Feeder Information**

Equipment Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Manufacturer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Model Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Pump Specs Attached? YES NO

Capacity of feeder (gallons per day): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Pressure gauge reading (psi): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(continued on next page)

Feeder is equipped with these features and parts (please indicate with check mark):

* Pressure relief valve
* Calibration chamber
* Anti-siphon valve
* Degasser head
* Backpressure valve
* Foot valve
* Diaphragm
* Ball check
* Valve seat
* Valve spring
* Injection fitting

**Appendix 6: Sampling Records**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

**Sampling for Coliform**

Total coliform bacteria are naturally present everywhere in the near surface environment, and finding total coliform bacteria in the water distribution system is an indicator that the system may have been exposed to contamination such as rain water runoff, dust, dirt, or possibly more serious contamination. The total coliform bacteria group is persistent and is used as an indicator that other, potentially harmful, bacteria may be present. Coliform bacteria found in more samples than allowed is a warning of potential distribution or source water problems. The presence of fecal coliform bacteria in the water system is indicative of animal waste contamination and needs an elevated response level to protect the public health of the water system customers. Through the routine monthly monitoring of coliform bacteria the public water supply system is verifying the integrity of the water system’s distribution piping and facilities (tanks).

The Total Coliform Rule is the federal regulation under the Safe Drinking Water Act that sets Maximum Contaminant Level (MCL) and monitoring requirements for certain biological contaminants. Every public water supply is required to periodically collect samples and analyze them for bacteria. The number of routine samples required each month depends on the system size and its source water. Some very small public water supplies with protected groundwater sources may have a reduced monitoring frequency granted to them by the Arizona Department of Environmental Quality (ADEQ) based on historical monitoring data and the public water supply’s source water assessment.

|  |  |  |  |
| --- | --- | --- | --- |
| **Minimum Number of Routine Bacteriological Samples Required** | | | |
| **Type of System** | **Population Served** |  | **Minimum Number of**  **Routine Samples** |
| Community Water Supplies and Non-Community Non-Transient Water Supplies | 25 - 1,000 |  | 1 sample per month\* |
| 1,001 – 2,500 |  | 2 samples per month |
| 2,501 – 3,300 |  | 3 samples per month |

\*Includes Public Water Supplies which have at least 15 service connections but serve less than 25 people.

All community and non-community public water supplies need to complete a sampling site plan and submit it to ADEQ. If you need to update or modify your current sampling site plan you will need to contact ADEQ for the latest form. To complete this sampling site plan you will need key contact information for the public water supply, the proposed routine monitoring location(s), an upstream monitoring location within five service connections of the routine monitoring location for each routine monitoring location, and a downstream monitoring location within five service connections of the routine monitoring location for each routine monitoring location. If you are a very small public water supply that only collects one bacteriological sample per monitoring period then you will also need to provide an additional repeat monitoring location. At least annually the water system operator needs to review the public water system’s sampling site plan and make any necessary corrections to the plan and file these changes with ADEQ.

The public water supply will collect samples at the routine monitoring sample location(s) each month and submit this sample(s) to a drinking water laboratory certified by ADEQ or U.S. Environmental Protection Agency (EPA) for bacteriological analysis. If the laboratory results are non-detect for coliform bacteria, then the public water supply will submit the results to ADEQ promptly**. If the results detect coliform bacteria, additional follow-up repeat sampling is required and the public water supply must notify ADEQ as soon as possible.**

All repeat samples must be collected according to the public water supply’s approved sampling site plan and within 24 hours of being notified of the routine positive results.

|  |  |  |
| --- | --- | --- |
| **Repeat Monitoring Required if Routine(s) Bacteriological Sample(s) Positive** | | |
| **Type of System** | **Population Served** | **Minimum Number of**  **Repeat Samples** |
| Community Water Supplies and Non-Community Non-Transient Water Supplies | 25 - 1,000 | 4 repeats samples (see plan) |
| 1,001 – 2,500 | 3 repeat samples per routine positive (see plan) |
| 2,501 – 3,300 | 3 repeat samples per routine positive (see plan) |

**For Groundwater Systems**

In addition to the monitoring in the table above, a raw source water bacteriological sample must be collected from each source water well(s) that operated in the previous 72 hours for each routine sample with positive results, please refer to the public water supply’s sampling site plan.

Follow-up with ADEQ on public notification requirements, emergency treatment protective actions required, and additional monitoring that may be required. These detailed procedures should be part of the Public Water Supply’s Emergency Response Plan.

**Sample Containers and Laboratory**

Use only sterile sample bottles that have been approved or provided by the laboratory performing the analysis. All drinking water certified laboratories must follow strict quality control and quality assurance practices according to the State of Arizona requirements.

Given the complexity of the analysis procedures and the equipment required, field analysis is not allowed. Bacteria samples must be analyzed at a State of Arizona certified drinking water laboratory. Be sure that the laboratory running the public water supply sample(s) is properly certified to run these samples and has been approved by ADEQ. A copy of approved drinking water laboratories can be obtained from ADEQ.

Review with the selected laboratory the time allowed for the sample to reach the laboratory after it is collected and the conditions in which it must be transported refrigerated or iced.

**How to Properly Collect a Coliform Sample**

Before you begin sampling, check and make sure you have the following supplies:

* Cooler for shipping and storage of your sample while in transit to the lab
* Ice for your shipping cooler
* Sample bottle with sodium thiosulfate powder or tablet (do not rinse bottle)
* Lab paperwork and labels for sample container identification

Recommended, but not required, items are:

* A chlorine spray and clean towel to clean sampling tap, if needed
* Paper towel for drying off outside of sample bottle after sample is collected and recapped
* Plastic storage baggies for ice and sample container

As a general rule, proper hand-washing both before and after collecting the sample is highly recommended for the person collecting the sample.

It is also recommended that you do not sample with any containers that appear to have been tampered with since this may cause a ‘positive’ result that is not representative of the drinking water system.

|  |  |
| --- | --- |
| Instructions | |
| 1. | Locate the proper sampling tap. |
| 2. | Remove aerator, strainer, or hose that may be present. |
| 3. | Clean the tap if needed. |
| 4. | Turn on the cold water to maximum flow to flush the service line. |
| 5. | Let the water run until line is completely flushed. *The sample should be of the distribution system not the building water.* |
| 6. | Reduce flow so stream is not greater than ¼ inch in diameter (*approximately, the width of a pencil).* |
| 7. | While the water is running, fill out labels, tags, and forms. |
| 8. | Place labels on bottles. |
| 9. | Do not change water flow once sampling has started. |
| 10. | Remove the bottle cap. |
| 11. | Do not touch the inside of the cap or the inside of the sample container with your fingers. |
| 12. | Hold cap downward away from potential splashing. |
| 13. | Hold bottle in one hand and the cap in the other. |
| 14. | Do not lay the cap down. |
| 15. | In one smooth motion, fill the bottle to 100 mL. *Many bottles have a 100-mL fill line.* |
| 16. | Fill the bottle to the shoulder or about ¼ inch from the top. |
| 17. | Recap immediately. |
| 18. | Tighten cap on sample container. |
| 19. | Bag sample separately so as not to risk contamination with ice pack. |
| 20. | Turn off tap and replace aerator, strainer, or hose. |
| 21. | Check that information on label is correct. |
| 22. | Complete all forms that come with sample bottles. |

**Chain of Custody Documentation**



**Appendix 7: Pumps**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

**Centrifugal Pump Checklist**

|  |  |
| --- | --- |
| **Daily**   * Check Packing * Check pump for bearings that may be noisy. * Check bearing oil for water and/or unusual color. * Check temperature of bearings by feel. * Inspect all bearing and oil rings. * Check for oil leaks, especially around gaskets. * Check that flow indicator and needle valve adjustments are functioning properly. * Check all mechanical seal conditions. * Check for leaks at casings and gaskets. * Listen for cavitation problems | Monthly   * Add oil to the bearing reservoirs, if necessary. * Check that oil level is correct distance from shaft centerline. * Clean out debris from bearing brackets.   Every 6 Months   * Apply light coat of rust protection to exposed surfaces.   Yearly   * Inspect couplings for signs of wear. Tighten bolts if necessary. * Check driver shaft for damage.   Seasonal   * Do an oil change, if required. Check manual. * Inspect for damaged or missing insulation. |

**Appendix 8: Hydrant Inspection Records**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

|  |
| --- |
| **Hydrant Inspection** |
| Hydrant Name: |
| Hydrant No: |
| Date of Inspection: |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Inspection Observation (if yes then pass)** | | | **Pass/Fail** | **Comments** | | |
| Structure | | |  | | | |
| Hydrant is accessible for water supply | | |  |  | | |
| Hydrant is upright without bent or deformations | | |  |  | | |
| Dischargers are accessible | | |  |  | | |
| All caps are present | | |  |  | | |
| Caps are hand tight only | | |  |  | | |
| No Leaks from caps | | |  |  | | |
| Hydrant valve in the on position | | |  |  | | |
| No leaks from top of hydrant | | |  |  | | |
| Nozzle threads are not damaged | | |  |  | | |
| Hydrant stem closes properly | | |  |  | | |
| Hydrant drains properly | | |  |  | | |
|  | | |  |  | | |
| **Pressure** | | | **Desired PSI** | **PSI During Inspection** | | **Pass/Fail** |
| If desired PSI and PSI during inspection are the same, mark “Pass” | | | | | | |
| Static Pressure on Hydrant | | |  |  | |  |
| Flow Pressure Using Pilot Gauge using 2 ½ discharge | | |  |  | |  |
|  | | |  |  | |  |
| **Flow** | **Desired Flow** | **Measured Flow** | | | **Pass/Fail** | |
| If desired flow and measured flow are the same, mark “Pass” | | | | | | |
|  |  |  | | |  | |

**Appendix 9: Water Storage Records**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

|  |
| --- |
| **Storage Tank Inspection Form** |
| Location: |
| Date of Exterior Coating Application: |
| Date of Interior Coating Application: |
| Date of Inspection: |
| Inspector: |

|  |  |  |  |
| --- | --- | --- | --- |
| INSPECTION | OBSERVATIONS | PASS/FAIL | COMMENTS |
| **Foundation** | If settling, cracks, deterioration are observed, then foundation failed inspection. |  |  |
| **Protective Coating** | If rust, pitting, corrosion and leaks are observed, then coating failed inspection. |  |  |
| **Water Level** | If coating of cable access is not protected and inoperable, then water level inspection failed. |  |  |
| **Pressure Tank Operational Status** | | | |
| Pressure release device |  |  |  |
| Pressure gauge |  |  |  |
| Air-water volume device |  |  |  |
|  | | | |
| **Roof Hatch:** | If low spots allow ponding water, if holes and rust are observed, then roof hatch inspection failed. |  |  |
| **Air Vents** | Lack of screens, unsealed edges and seams means inspection failed. |  |  |
| **Access Ladder** | If ladder contains loose bolts or rungs, then inspection failed. |  |  |
| **Overflow Pipe:** | If flap valve cover is inaccessible, unsealed and or inoperable, then overflow pipe inspection failed. |  |  |
| Cathodic Protection Anode Plates | If not secured or sealed, then inspection failed. |  |  |
| **Interior Inspection** | | | |
| Water Quality | If floating insects or debris are observed on the water surface and/or settlement is observed on the bottom, then water quality failed inspection. |  |  |
| **Protective Coating** | If rust, corrosion, and/or scarring is observed, then protective coating inspection failed. |  |  |

**Appendix 10: List of Vendors**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **Contact name** | **Phone** | **Cell** | **Email** |
| Water Testing Lab |  |  |  |  |
| Water Testing Lab |  |  |  |  |
| Pump Supplier |  |  |  |  |
| Equipment Vendor |  |  |  |  |
| Equipment Vendor |  |  |  |  |
| Equipment Vendor |  |  |  |  |
| Chemical Supplier |  |  |  |  |
| Chlorine Supplier |  |  |  |  |
| Electrical Contractors |  |  |  |  |
| Safe Dig |  |  |  |  |
| Other: |  |  |  |  |

**Appendix 11: Confined Space Entry Permit Checklist**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

**Confined Space Pre-Entry Checklist/Confined Space Entry Permit**

Start Date and Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ End Date and Time:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Job Site/Space ID:\_\_\_\_\_\_\_\_\_\_\_

Supervisor:\_\_\_\_\_\_\_\_\_\_\_\_\_

Equipment to be Worked on:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Work to Complete:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Personnel on Standby:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Atmospheric Checks:

Time\_\_\_\_\_\_\_\_\_\_\_ Oxygen \_\_\_\_\_\_\_\_\_\_\_% Toxic \_\_\_\_\_\_\_\_\_\_\_ ppm

Explosive \_\_\_\_\_\_\_\_\_\_\_% LEL Carbon Monoxide \_\_\_\_\_\_\_\_ ppm

Tester’s Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Source Isolation: (No Entry) N/A Yes No

Pumps or lines blinded ( ) disconnected ( ) blocked ( )

3. Ventilation Modification: N/A Yes No

Mechanical ( ) Natural Ventilation Only ( )

4. Atmospheric Check After Isolation and Ventilation:

Time \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Oxygen \_\_\_\_\_\_\_\_\_\_\_\_\_ % > 19.5% Toxic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ppm < 10 ppm H2S

Explosive \_\_\_\_\_\_\_\_\_\_\_ % LFL < 10% Carbon Monoxide \_\_\_\_\_\_\_\_\_ppm < 35 ppm CO

Tester’s Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Communication Procedures: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Rescue Procedures: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Entry, Standby, and Backup Personnel Yes No

Successfully completed required training? \_\_\_\_\_\_

Is training up to date? \_\_\_\_\_\_\_\_

8. Equipment: N/A Yes No

Direct reading gas monitor tested:\_\_\_\_\_\_\_\_\_\_\_\_

Safety harness and lifelines for entry and standby personnel \_\_\_\_\_\_\_\_

Hoisting apparatus \_\_\_\_\_

Powered communications \_\_\_\_\_\_\_\_\_\_\_

SCBAs for entry and standby personnel \_\_\_\_\_\_\_\_\_\_

Proper protective clothing \_\_\_\_\_\_\_\_\_\_\_\_\_\_

All electric equipment listed for Class I, Division I,\_\_\_\_\_\_\_\_\_\_\_

Group D and non-sparking tools \_\_\_\_\_\_\_

9. Periodic atmospheric tests:

Oxygen: \_\_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_;

Explosive: \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_;

Toxic: \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_;

Carbon Monoxide: \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_; \_\_\_\_\_\_% Time\_\_\_\_\_;

We have reviewed the work authorized by this permit and the information contained. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any brackets of the above are marked as no. This permit is not valid unless all appropriate items are completed.

Permit Prepared By: (Supervisor) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Approved By: (Unit Supervisor)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reviewed By: (CS Operations Personnel) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*This permit is to be kept at the job site. Return job site copy to Safety Office following completion of the job.*

**Appendix 12: Work Order**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WORK ORDER** | | | | | | | | | |
| ORDER DATE | |  | |  | | ORDER COMPLETED DATE | |  | |
| DESCRIPTION OF TASK NEEDED | |  | | | | | | | |
| LOCATION | |  | | | | | | | |
| WORK DESCRIPTION | | | | | | | | | |
| LABOR DESCRIPTION | | | MATERIALS | | | | EQUIPMENT DESCRIPTION | | |
| STAFF NAME | HOURS | | TYPE | | COST | | TYPE OF EQUIPMENT | | HOURS |
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| NOTES: | | | | | | | | | |

**Appendix 13: Emergency Operations Plan/Emergency Response Plan**

If a form for this section exists and is in use for your system, then add the existing form behind this page.

|  |  |  |
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| **Staff Name** | **Date of Training** | **Signature** |
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