Minnesota Department of Health
Minnesota Rural Water Association

Class E Study Guide

This study guide is designed for operators taking the Class E water certification exam. It also serves as a workbook for Class E continuing education courses. It is a condensed version of *Safe Drinking Water for Your Small Water System: An Operator's Guide*.

Disclaimer

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This study guide presents a summary of regulations applicable to small drinking water systems. Should the summarized information in this document be inconsistent with a governing rule or statute, the language of the rule or statute shall prevail.

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Safe Drinking Water Act

The Federal Safe Drinking Water Act (SDWA) is the principal regulation governing public water systems in Minnesota. It defines what a public water system is, sets drinking water quality standards, institutes water sampling and survey schedules, establishes requirements for source water protection, operator certification, and more.

Water System Types

Nonmunicipal Community

A nonmunicipal community public water system "serves at least 25 year-round residents, or serves 15 service connections used by year-round residents." A private party owns these systems. Nursing homes, prisons, mobile home parks, housing developments and apartments are among the different types of nonmunicipal community systems.

Nontransient Noncommunity

A NTNC-PWS system is "a public water supply that is not a community water supply and that regularly serves at least 25 of the same persons over six months per year." Factories, office buildings, day-care centers, and schools are among the different types of nontransient noncommunity systems.

Comparison of Requirements: Nonmunicipal Community vs. Nontransient Noncommunity Water Systems

REQUIREMENT	**NONMUNICIPAL COMMUNITY –** Apartments, housing developments, nursing homes, prisons, mobile home parks	**NONTRANSIENT NONCOMMUNITY –** Schools, daycares, office buildings, factories
SAMPLING	Water system collects bacteria samples quarterly (unless on increased monitoring due to population over 1000, surface water source, etc.).	MDH collects most bacteria samples (unless on increased monitoring due to population over 1000, surface water source, etc. – then system collects).
	Water system collects nitrate samples annually (unless on increased monitoring).	MDH collects most nitrate samples (unless on increased monitoring – then system collects).
	Water system collects lead and copper samples when required.	Water system collects lead and copper samples when required.
	MDH collects IOC, SOC, and VOC samples.	MDH collects IOC, SOC, and VOC samples.
RESPONSE TO MCL VIOLATION	Public notification can be made via methods such as newspaper, handouts, etc.	Public notification made by posting warning notices at all potential drinking water taps.
	For a bacteriological violation: A "Boil Order" may be issued by MDH.	*For a bacteriological violation:* Boiling is not always practical for users of water supply. Generally, consumption is restricted and an alternate source of water (such as bottled water) is provided.
	The system may be required to provide water from an approved source (such as bottled water).	The system is required to provide water from an approved source (such as bottled water).
CONSUMER CONFIDENCE REPORT (CCR)	CCR is due to be completed and distributed by July 1st of each year.	**Not required for noncommunity systems.**
	MDH mails the report to the operator, who completes the needed information.	
PLAN REVIEW	Must submit plans for new construction and any changes or modifications made to the existing system.	Must submit plans for new construction and any changes or modifications made to the existing system.
	Must submit plans for all water treatment systems.	Must submit plans for all water treatment systems that are to be used to comply with a Safe Drinking Water Act requirement.
	Must submit plans for new wells before they are drilled.	Plans are not required for new wells. However, driller must submit a well notification to MDH.
ISOLATION DISTANCES	All wells must meet the isolation distances specified in the Minnesota Well Code **and** all wells must have a minimum isolation distance of 50 feet from any potential contamination source.	All wells must meet the isolation distances specified in the Minnesota Well Code.

Operator Certification

All nontransient noncommunity (NTNC) and community water systems are required to have at least one certified water operator. These systems are placed into an operator certification class (A through E), based on factors such as the complexity of treatment and the number of people they serve. Most NTNC water systems and nonmunicipal community water systems will fall into the "lower" categories – either a Class D or E water system classification. The following items designate the certification qualifications for both Class D and E water operators.

Certification Requirements for Class D and E Operators

- All applicants must have a high school diploma or equivalent.
- A Class D applicant must have at least **one year** of experience in the operation of a Class A, B, C, or D system.
- A Class E applicant must have at least **three months** of experience in the operation of a Class A, B, C, D, or E system.

Renewal of Certificates

All operators will need to complete continuing education in order to renew their certificates and remain certified. The amount of continuing education hours will depend on the operator's certificate. Operator certificates are valid for three years. The continuing education must be completed **before** the certificate expires.

Certification Class	***Contact Hours Per 3 Year Cycle***
E	**4**
D	**8**
C	16
B	24
A	32

Record Keeping Requirements

Minimum For All Records (MDH correspondence)	Bacteria Results	Nitrate & Other Chemical Results (except lead & copper)	Lead & Copper Results	Sanitary Survey Reports
Any records related to SDWA (i.e. Notice of Violation) must be kept for a minimum of three (3) years.	5 years	10 years	12 years	10 years

Recommended Standards For Operating and Maintaining Your Water System

Wells

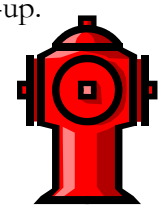
- Know the location of your well(s) and inspect the well(s) on a routine basis.
- Provide a secure and intact well cap. Older well caps often do a poor job of keeping insects and dirt out of the well. If possible, replace older caps with an overlapping well cap that includes a compression gasket and screened vent.
- Be sure the well casing extends at least **one foot** above the ground surface to reduce the possibility of surface water or other contaminants entering the well. Avoid landscaping projects that reduce the distance between the ground and the top of the well casing to less than the required minimum distance.
- The casing shall be vented to the atmosphere. For **community** water supplies, the vent shall end at least 18 inches above the finished floor elevation.
- Direct surface and roof runoff away from the well. Surface water should not collect near the well.
- Protect wells from potential vehicle damage. Direct vehicular traffic away from the well or surround the well casing with rigid posts or large rocks to help protect the well from damage.
- To the extent possible, remove any potential sources of contamination from the area near the well. All new wells must meet the minimum requirements for separation from potential contaminant sources such as drain fields and fuel tanks.
- Properly seal all unused wells on the property.

Treatment

- Operate and maintain all water treatment devices according to the manufacturer's specifications. Poorly maintained treatment devices often lead to water quality problems.
- Provide a watertight and covered brine tank for water softeners. Store all water softener salt up off the floor surface to prevent contamination.
- Provide a raw water sample tap prior to any treatment.

Distribution

- Eliminate cross connections and dead ends in the plumbing system. A dead end, as the name implies, is a portion of your drinking water piping that does not have water regularly moving through it. Dead ends result in stagnant water that deteriorates and can affect water quality elsewhere in the system. Plumbing cross connections potentially allow contaminants to enter the potable water supply.
- Always disinfect the plumbing system after repairs or modifications. New fixtures, piping, or other plumbing components can introduce bacterial contamination. All seasonal wells and plumbing systems should be disinfected prior to start-up. Be sure to thoroughly flush all lines before returning to use.
- Exercise valves and fire hydrants on a routine basis to ensure that they will work properly when needed.



Other Requirements

- Designate an individual (perhaps yourself!) to become the certified water operator for the system. Make sure that individual receives certification from the state and attends continuing education classes.
- Prior to making changes to the water system, determine if plan review is needed. If it is, make sure that plans are reviewed and approved by the Minnesota Department of Health (MDH) before proceeding.
- Know whom to contact in case of emergency if there are problems with your water system. This includes MDH staff, a well contractor, and a plumber.

Public Water System's Responsibilities in Providing Safe Drinking Water

- ✓ **Drinking Water Standards** – The water supplied by the water system must meet all established, legally enforceable drinking water standards. Water testing must show that the water quality does not exceed the established maximum contaminant level (MCL) for each regulated contaminant.
- ✓ **Public Notification** – Each public water system must notify its customers when it does not meet an established drinking water standard.
- ✓ **Certified Operator** – Each nontransient noncommunity and nonmunicipal community public water system must designate at least one water system operator. This operator must be certified by the State of Minnesota.
- ✓ **Sampling** – Although MDH program staff accomplishes most SDWA compliance monitoring, the public water system is still responsible for some sampling. This monitoring may include lead and copper sampling and monthly/quarterly bacteriological sampling.
- ✓ **Source Water Protection** – Source water protection involves preventing contamination of your water supply by effectively managing potential sources of pollutants. All public water systems are required to implement source water protection measures, such as meeting all isolation distances for potential contaminant sources. Additionally, all nontransient noncommunity and nonmunicipal community public water systems will develop a formal wellhead protection plan, with assistance from MDH staff.
- ✓ **Well Code Compliance** – Installation of new wells and modifications of existing wells must meet the requirements of the Minnesota Well Code (Minnesota Rules, Chapter 4725).
- ✓ **Plumbing Code Compliance –** All installation and modification of plumbing components must meet the requirements of the Minnesota Plumbing Code (Minnesota Rules, Chapter 4715).
- ✓ **Plan Review** – Plans must be submitted for changes or additions to plumbing, installation of a new water treatment system or changes made to an existing treatment system.
- ✓ **Record Keeping** – Records of sampling, sanitary surveys, and other correspondence from MDH must be kept on file by the water system. It is recommended that all information be kept at one location on the premises.
- ✓ **Consumer Confidence Report (CCR)** – All **community** water systems must provide an annual water quality report called a Consumer Confidence Report (CCR) to their customers. Each year, all community water systems will receive a ready-to-go report from MDH. The operator will need to complete some information for the report. The goal of the CCR is to provide information to customers about their drinking water. The reports must be completed and distributed by July 1 of each year and will cover monitoring activities through the end of the previous calendar year. **This requirement applies to community water systems only.**

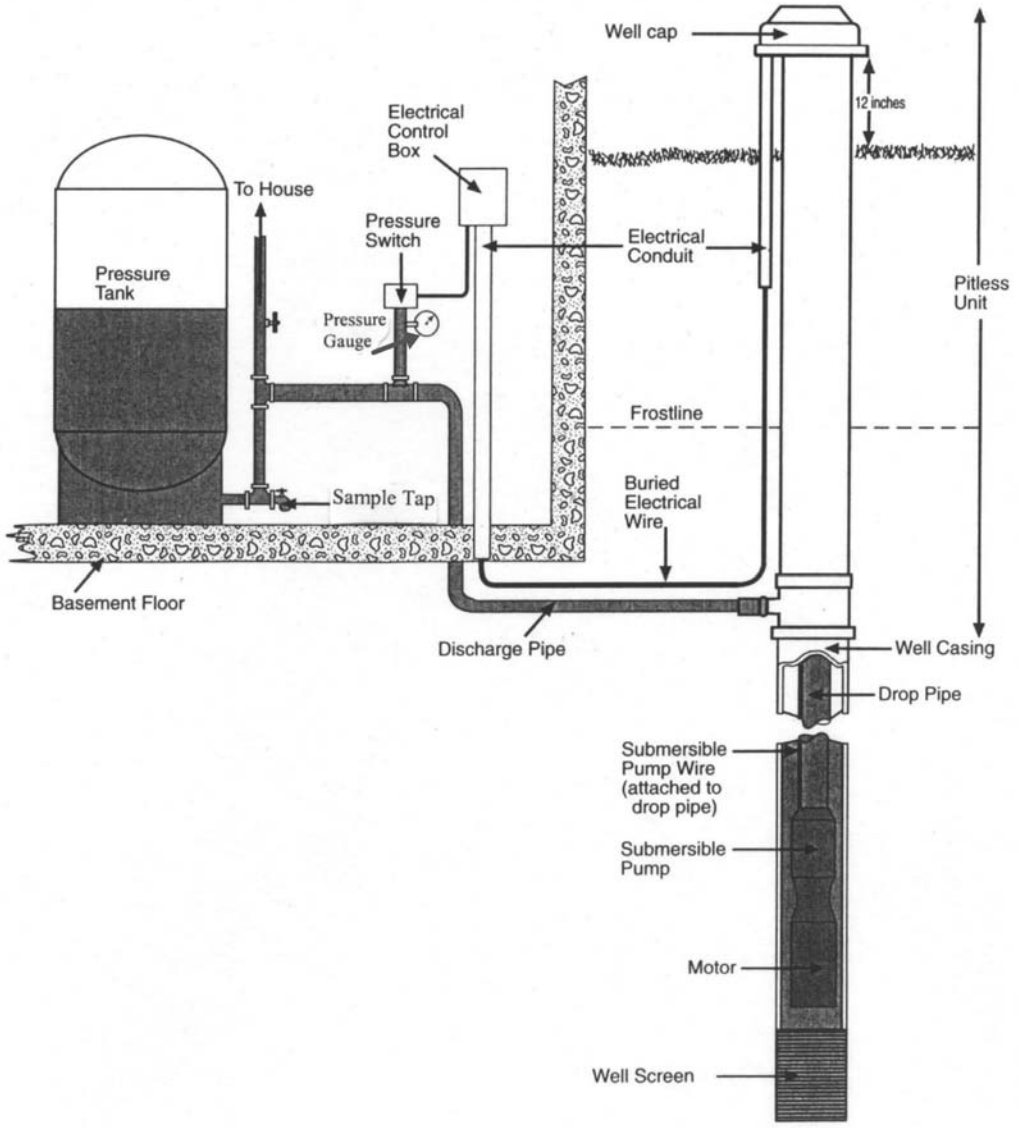
Source Water Protection

Drinking water contamination creates potential health problems and increases expenses for well owners as they seek to correct the problem. From both a health and cost perspective, it is preferable to prevent contamination from happening in the first place. Because preventing contamination is so important, all public water systems in Minnesota are required to implement "source water protection." The following points briefly describe the responsibilities of public water supplies in source water protection.

- Be sure that any new contamination sources meet the isolation distances defined in the Minnesota Well Code.
- Monitor (or relocate) all existing contamination sources that don't meet the required isolation distance.
- Implement wellhead protection measures for contaminant sources within your inner wellhead management zone (IWMZ) – the area within 200 feet of your well in all directions. These measures include performing maintenance, educating staff, changing work practices, or moving potential contaminant sources.
- Develop and implement your wellhead protection plan.

Groundwater Wells

The quality of water produced by a well depends on **where** the well is constructed and **how** it is constructed. "Isolation distances" are the minimum physical separation that must exist between a well and a potential source of contamination (such as a septic system). The isolation distances are based on the ability of soil and bedrock to remove certain types of contaminants from the groundwater before they reach the well.



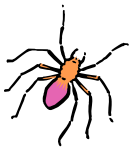
Well Casing

The casing provides a connection to the groundwater and a pathway for bringing the water to the surface. Casing also prevents loose soil, sediment, rock, and contaminants from entering the well.

Well Cap

Weatherproof and insect-proof water supply well covers are required to prevent contamination of the well. Electrical connections for the pump and any treatment installations also require weatherproof and insect-proof covers.

Well Ventilation



An air vent is needed for most wells to allow air to enter the well when the pump turns on to prevent the well from collapsing due to the vacuum that is created. A vent is also needed to relieve pressure after the pump is shut off. This vent is usually part of the well cap. Having the vent screened and down-turned helps prevent contamination of the well. Without the screen in place, the well can easily become contaminated by insects, dust, debris, etc.

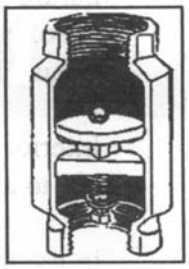
Sanitary Well Seal

A sanitary well seal is used instead of a well cap on wells that have piping exiting at the top of the casing, for example, a well with a jet pump. A one-piece top plate sanitary seal must be used for wells in outdoor locations. A two-piece top plate sanitary seal may be used for wells located inside of a well/pump house.

Discharge Line or Water Service Line

The discharge line or water service line delivers the water from the well to the buildings being served. This pipe must meet the minimum requirements of the Minnesota Plumbing Code for water service lines.

Check Valve



The check valve is used to prevent water from flowing back down into the well when the pump has been shut off. If the check valve fails, the water flowing back down into the well will stir up the geological formation, which may cause silt, sand, or other materials to be present in the drinking water.

Drop Pipe

A drop pipe is a vertical pipe that carries water from a submersible pump, located in the well casing, to an underground discharge coupling (pitless adapter or pitless unit), or out the top of the casing.

Well Screen

The purpose of the well screen is to prevent sediment from entering the well while allowing water to enter the well.

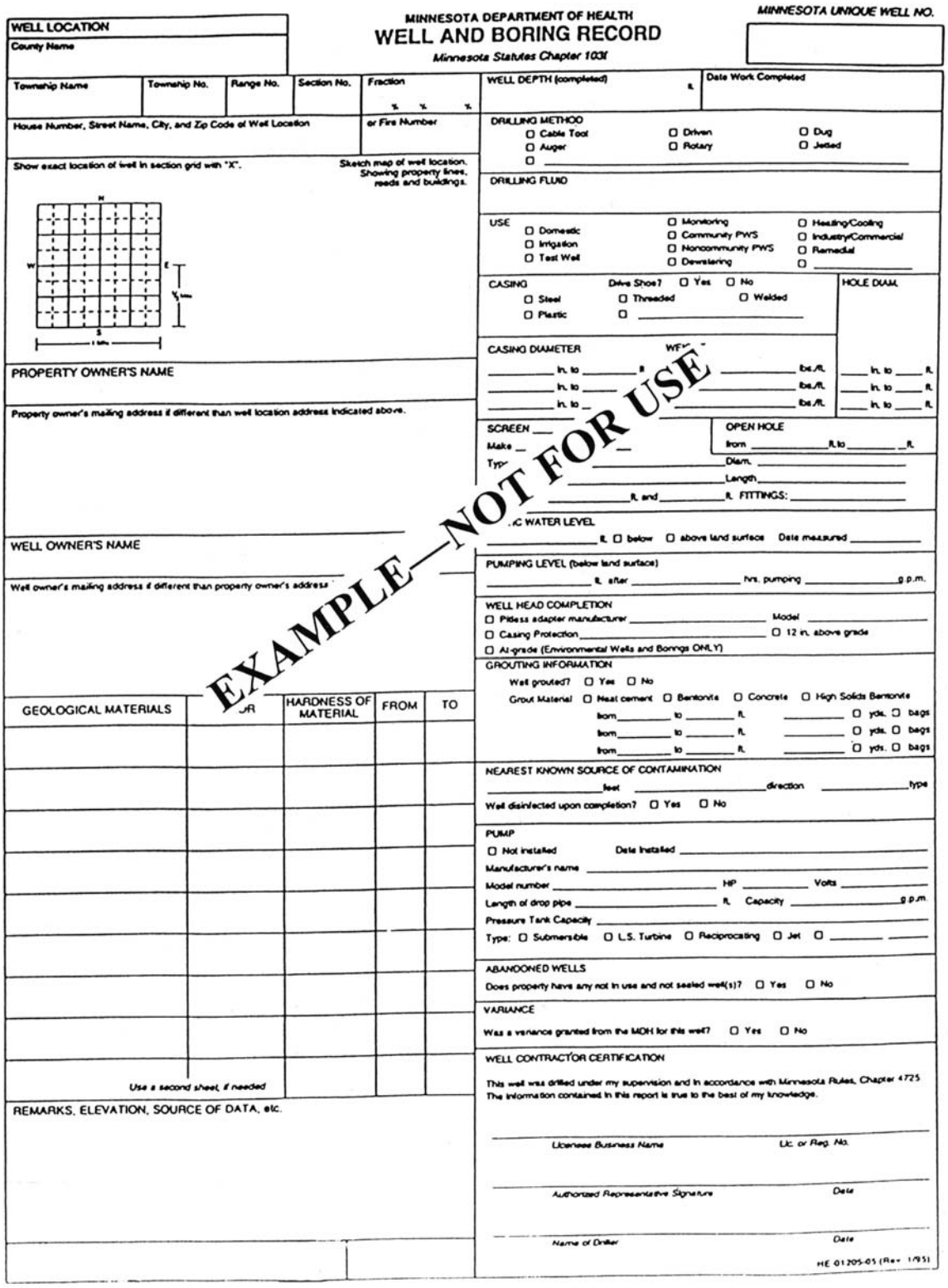
Submersible Pump

This pump is designed to operate completely submerged under water in the well casing and pumps water from the well to the distribution system.

Raw Water Sample Tap

A raw water sample tap allows for collection of water samples prior to any treatment. To prevent possible contamination of the water supply, the tap must have the threads ground off to prevent connecting a hose to the tap.

Well Log



MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

MINNESOTA UNIQUE WELL NO.

WELL LOCATION
County Name
Township Name | Township No. | Range No. | Section No. | Fraction
House Number, Street Name, City, and Zip Code of Well Location | or Fire Number
Show exact location of well in section grid with "X". Sketch map of well location. Showing property lines, roads and buildings.

PROPERTY OWNER'S NAME
Property owner's mailing address if different than well location address indicated above.
WELL OWNER'S NAME
Well owner's mailing address if different than property owner's address

WELL DEPTH (completed) ft. | Date Work Completed

DRILLING METHOD
☐ Cable Tool ☐ Driven ☐ Dug
☐ Auger ☐ Rotary ☐ Jetted
☐ _____

DRILLING FLUID

USE
☐ Domestic ☐ Monitoring ☐ Heating/Cooling
☐ Irrigation ☐ Community PWS ☐ Industry/Commercial
☐ Test Well ☐ Noncommunity PWS ☐ Remedial
☐ Dewatering ☐ _____

CASING Drive Shoe? ☐ Yes ☐ No
☐ Steel ☐ Threaded ☐ Welded
☐ Plastic ☐ _____

HOLE DIAM.

CASING DIAMETER WEI
_____ in. to _____ ft. _____ lbs./ft. ____ in. to ____ ft.
_____ in. to _____ ft. _____ lbs./ft. ____ in. to ____ ft.
_____ in. to _____ ft. _____ lbs./ft. ____ in. to ____ ft.

SCREEN
Make
Type Diam.
Length
ft. and ft. FITTINGS:

OPEN HOLE
from ft. to ft.

STATIC WATER LEVEL
ft. ☐ below ☐ above land surface Date measured

PUMPING LEVEL (below land surface)
ft. after hrs. pumping g.p.m.

WELL HEAD COMPLETION
☐ Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

GROUTING INFORMATION
Well grouted? ☐ Yes ☐ No
Grout Material ☐ Neat cement ☐ Bentonite ☐ Concrete ☐ High Solids Bentonite
from to ft. ☐ yds. ☐ bags
from to ft. ☐ yds. ☐ bags
from to ft. ☐ yds. ☐ bags

NEAREST KNOWN SOURCE OF CONTAMINATION
feet direction type
Well disinfected upon completion? ☐ Yes ☐ No

PUMP
☐ Not installed Date Installed
Manufacturer's name
Model number HP Volts
Length of drop pipe ft. Capacity g.p.m.
Pressure Tank Capacity
Type: ☐ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

VARIANCE
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

WELL CONTRACTOR CERTIFICATION
This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.
Licensee Business Name Lic. or Reg. No.
Authorized Representative Signature Date
Name of Driller Date
HE 01205-05 (Rev. 1/95)

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO

Use a second sheet, if needed

REMARKS, ELEVATION, SOURCE OF DATA, etc.

EXAMPLE—NOT FOR USE

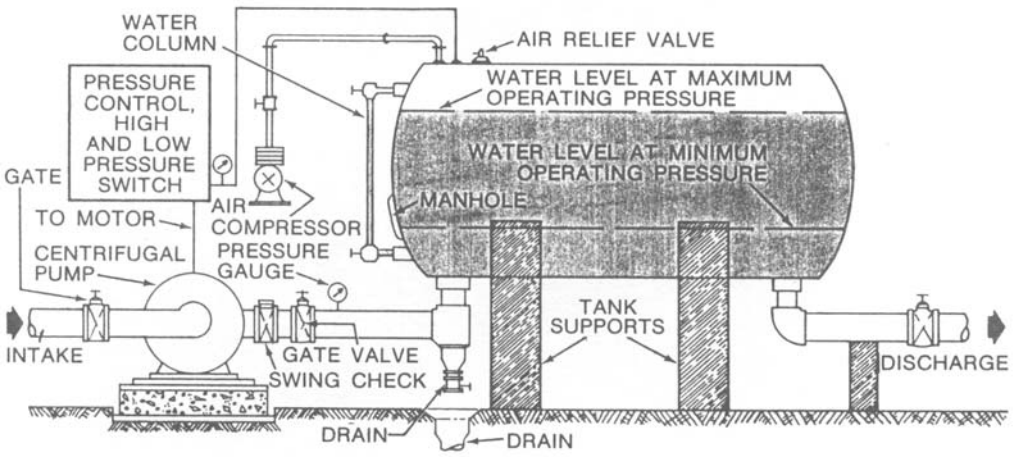
Storage and Pressure Tanks

Storage tanks can serve the following two purposes:

1) Provide storage volume so the well pump does not have to operate for every water use; and
2) Provide pressure to the distribution system.

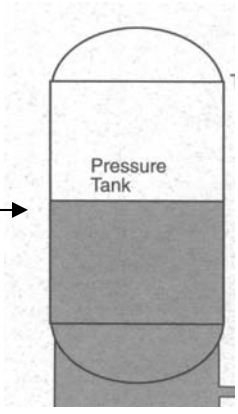
Hydropneumatic Pressure Tanks

Hydropneumatic tanks operate using a pressure-rated tank containing approximately two-thirds water and one-third air at full capacity. These tanks do not have a barrier separating the air and water in the tank.



Bladder Pressure Tanks

Shown in the diagram is a small-scale pressure tank that uses a "bladder" as a flexible barrier between air and water in the tank. The bladder prevents loss of air to the water.



New Installation

Hydropneumatic pressure tanks and bladder pressure tanks are allowed at systems that provide water to fewer than 50 persons.

Well Disinfection

When to Disinfect

Well disinfection can eliminate or reduce many kinds of harmful bacteria and viruses as well as nonharmful bacteria which can cause unpleasant taste and odors. However, disinfection will **not** correct water problems caused by chemical contamination from nitrate, fuels, pesticides, or other substances. Well disinfection should be performed under the following circumstances:

- When coliform bacteria are present in the water
- After flooding of the well
- After plumbing installation, (e.g. softeners, sinks, filters)
- After casing or pump repairs – submersible types or other
- When drinking water tastes or odors change, (e.g. from iron or sulfur reducing bacteria)
- As part of annual maintenance
- During startup of seasonal wells

Safety

ELECTRICAL

EXTREME CAUTION is advised, as you will be working with electricity and water. Potentially lethal voltages exist – if you are not acquainted with working with electricity, seek professional advice. Your safety precautions should include:

- Turn off the pump circuit breaker before removing the well cap
- While the breaker is off, examine for chafed wire insulation or missing wire nuts and repair as necessary
- Wear rubber soled shoes or boots, preferably waterproof

CHEMICAL

Severe eye damage may result from contact with chlorine, including bleach and highly chlorinated household water.

- Users of the water must be warned to not drink or bathe with the water while chlorine is still present in the system. (This applies to high level shock treatment for disinfecting the well and distribution system, not routine disinfection where a low level of chlorine is present in the water at all times.)
- Do not leave bleach jugs lying around – ingestion of bleach is the most common toxic exposure for children in the U.S.
- Wear protective goggles or a face shield when working with the bleach.

RESPIRATORY

Well pits pose an extreme hazard as they frequently contain a build-up of toxic gases or simply lack oxygen to sustain life.

- DO NOT ENTER WELL PITS. Death can occur in even a shallow well pit.
- Leave disinfection of wells in pits to licensed well or pump contractors.

Well Disinfection Procedure

- **STEP 1 – Isolate critical areas**
  - Bypass softeners, bait tanks, livestock, and anything else that might be vulnerable to chlorine to prevent damage to the device or animals.
  - Install a new filter element if the water system has any present.
  - Since softeners themselves may be a source of contamination, it is good to disinfect the softener at the same time the well is being disinfected. See the end of this section for a softener disinfection procedure.

- **STEP 2 – Electrical safety**
  - Turn off the electrical power to the pump. If the breaker box has a "lockout" hasp to prevent someone from accidentally turning on the water pump circuit breaker, use it.

- **STEP 3 – Remove well seal/cap**
  - With electrical power off, remove the well cap and lift the wires/wire nuts out and pull to the side.

- **STEP 4 – Mix a chlorine solution**
  - For 4-inch diameter wells that are 100 feet deep, add a half-gallon of bleach to a clean pail with about 3 gallons of water. For wells greater than 100 feet deep or with a larger casing diameter, increase the amount of bleach proportionately.
  - If you have a dug well with a diameter greater than 18 inches, use 2 to 4 gallons of bleach added directly to the well. Please note that many dug wells are difficult or impossible to disinfect due to their unsanitary construction.

- **STEP 5 – Pour chlorine mixture into well**

- **STEP 6 – Recirculate chlorinated water**
  - Recirculation of chlorinated water helps to wash down the sidewalls of the well casing, mix the water column thoroughly, and distribute the chlorine.
    - Place garden hose into well casing

- Turn on pump power
- Run garden hose from the water system and put it back into the casing to recirculate water. Recirculate this for about 2 hours after the chlorine smell appears from the garden hose.
- You may notice that the water coming from the garden hose turns reddish for a brief period. This is due to the chlorine precipitating iron in the water. If the water appears excessively red and cloudy from this reaction, discharge the hose outside of the casing until the water runs clear.

- **STEP 7 – Bring chlorine to each faucet**
  - While water is circulating, run water from each fixture one at a time until you smell bleach (or use chlorine test papers), and then close the faucet. Do this for each faucet, including:
    - Cold and hot water taps
    - Toilets and shower/bath fixtures
    - Any outside faucets or yard hydrants
  - Faucet aerators may need to be removed if clogging occurs from precipitated iron.
  - Chlorine test papers, such as those commonly used in restaurants to check chemical sanitizing dishwashers, are not necessary but provide a visual indication that chlorine is present.

- **STEP 8 – Remove the chlorinated water**
  - Let system set overnight with chlorine in the water lines. In the morning, run a garden hose to flush out the system.
  - Since chlorine will kill vegetation, direct the water to an area where it won't matter if plants are harmed.
  - Do not run the water into your septic system as the amount of water required to flush the system may hydraulically overload the septic system.
  - TOTAL chlorine must be absent prior to taking water samples for coliform analysis. Be aware that any amount of chlorine left in the system may erroneously result in a negative coliform test.
  - When a chlorine test is unavailable, wait a few days after the last trace of chlorine odor has been smelled before submitting a water sample for coliform analysis. This will ensure a valid test result.

Disinfection Issues

Expectations and Concerns

- It may take as little as half an hour or as much as 4 days to completely remove the chlorine odor from the water system. To facilitate faster removal of the chlorine in stubborn cases, a hose splitter may be attached and one hose run back into the casing and the other hose pumped to waste.
- Water heaters take a long time to flush out once chlorine has been introduced into them. Do not shower/bathe with water containing high levels of chlorine due to the possibility of damaging your eyes.
- It is not unusual to require 2, 3, 4, or more disinfections to clear water systems of coliform bacteria that have been growing in the system for a period of time. If the well refuses to clear, a licensed well driller should be enlisted to utilize special techniques and equipment to flush the well. It is essential that any water system defects that could allow surface water to enter the well be corrected.
- Plumbing grit and precipitated minerals may form when the chlorine is added to the system. This grit can cause clogging with faucet aerators, flush valves, water solenoids, and equipment using filters.

Softener Disinfection

- Water softeners may be damaged by excessive amounts of chlorine but the softener itself should be chlorinated when there are bacteria problems. Follow the manufacturer's instructions for disinfecting the particular unit you have, or use this procedure:
    - During the disinfection process, turn softener to 'Bypass' once chlorine is first smelled in a softened water tap.
    - Keep unit on bypass until chlorine is flushed out of the system.
    - To disinfect the softener, add ½ cup bleach to the brine tank and regenerate the unit.

Follow-up

- Frequently, coliform bacteria will regrow in the water system after about a month. For this reason, it is important to retest in approximately 30 days after disinfection. If coliform is again detected, disinfect the well using the same procedure.

Regulated Drinking Water Contaminants

CONTAMINANT	MCL/ ACTION LEVEL (AL)*	SOURCE	HEALTH RISKS CHRONIC/ACUTE**	MONITORING FREQUENCY***	SAMPLE COLLECTOR****
BACTERIA (MICROBIOLOGICAL)	0 (NO COLIFORM BACTERIA SHOULD BE PRESENT)	NATURALLY OCCURING IN THE ENVIRONMENT/HUMAN AND ANIMAL WASTES	ACUTE	ANNUAL	MDH
NITRATE (INORGANIC)	10 mg/L	ANIMAL WASTES AND FERTILIZERS	ACUTE – INFANTS UNDER 6 MONTHS OF AGE WHO DRINK WATER HIGH IN NITRATES MAY BECOME SERIOUSLY ILL (BLUE BABY SYNDROME) AND MAY DIE	ANNUAL	MDH
ARSENIC (INORGANIC)	0.01 mg/L	NATURALLY OCCURING MINERAL IN SOIL AND BEDROCK. BEDROCK AND UNDERGROUND SOIL	CHRONIC	1 SAMPLE EVERY 3 YEARS AND REDUCED BASED ON HISTORICAL MONITORING	MDH
LEAD/COPPER	LEAD 0.015 mg/L COPPER 1.3 mg/L	LEAD PIPES, SOLDER IN HOUSEHOLD PLUMBING, AND BRASS FIXTURES	CHRONIC	BEGINS EVERY 6 MONTHS AND REDUCED BASED ON HISTORICAL MONITORING	WATER SYSTEM

* **Maximum Contaminant Level (MCL) is the greatest amount of a particular contaminant allowed in drinking water. Action Level (AL) is a contaminant concentration that if reached in a certain percentage of samples requires specified actions by the public water supply.**

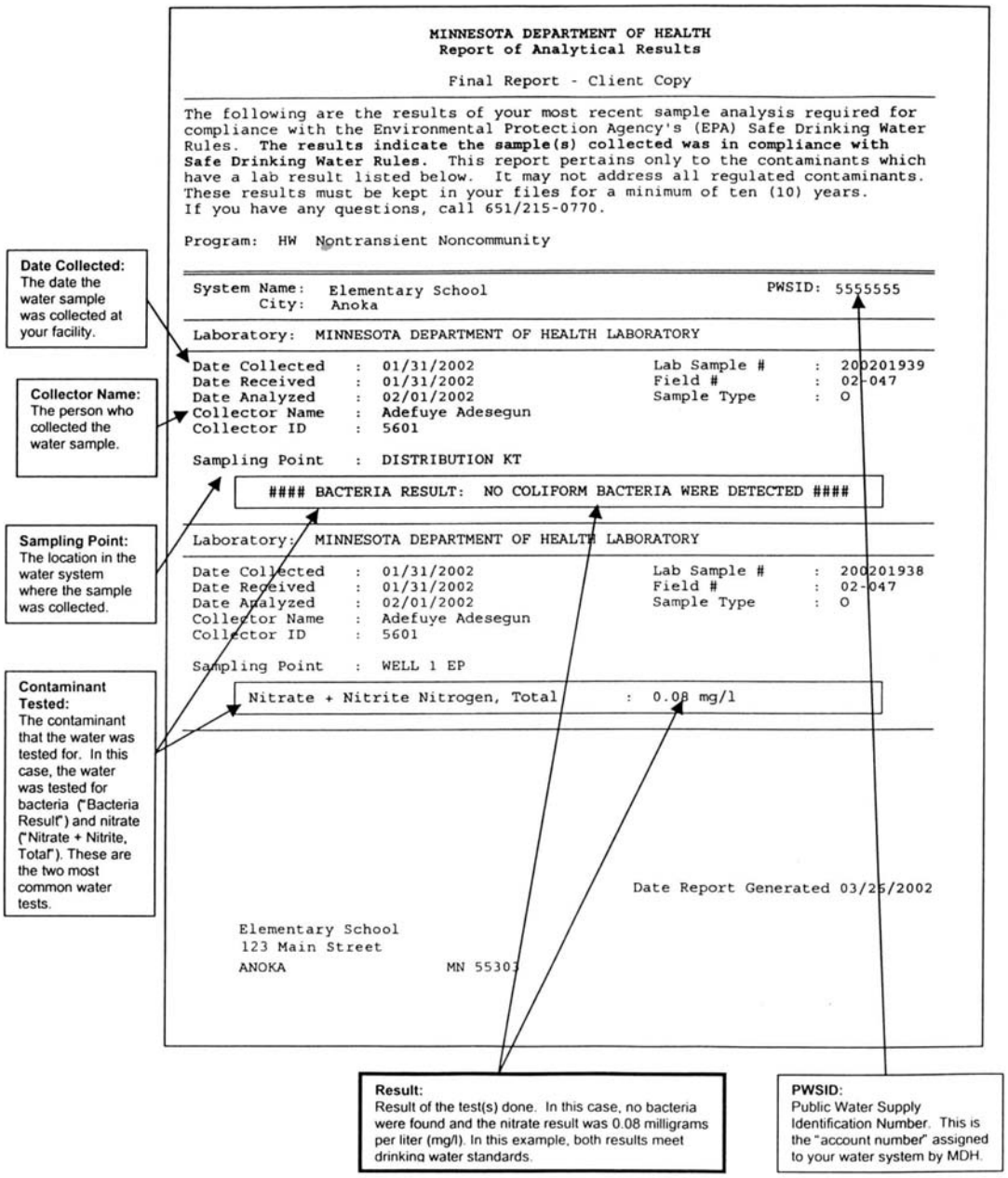
** **Most contaminants are considered chronic, meaning that cancer or other ill health may result if the contaminant is consumed at relatively low concentrations over extended periods of time. Acute contaminants may have the potential to pose an immediate health risk if consumed.**

*** **Additional monitoring may be required if contaminants are detected at elevated levels or certain population requirements are met.**

**** **Community water supplies typically collect their own nitrate and coliform samples.**

Sample Results Forms

Example Water Test Result Report – Routine Coliform Bacteria and Nitrate Results
The information given below explains the information provided on routine bacteria and nitrate reports. *



MINNESOTA DEPARTMENT OF HEALTH
Report of Analytical Results

Final Report - Client Copy

The following are the results of your most recent sample analysis required for compliance with the Environmental Protection Agency's (EPA) Safe Drinking Water Rules. **The results indicate the sample(s) collected was in compliance with Safe Drinking Water Rules.** This report pertains only to the contaminants which have a lab result listed below. It may not address all regulated contaminants. These results must be kept in your files for a minimum of ten (10) years. If you have any questions, call 651/215-0770.

Program: HW Nontransient Noncommunity

System Name: Elementary School PWSID: 5555555
City: Anoka

Laboratory: MINNESOTA DEPARTMENT OF HEALTH LABORATORY

Date Collected : 01/31/2002 Lab Sample # : 200201939
Date Received : 01/31/2002 Field # : 02-047
Date Analyzed : 02/01/2002 Sample Type : O
Collector Name : Adefuye Adesegun
Collector ID : 5601

Sampling Point : DISTRIBUTION KT

BACTERIA RESULT: NO COLIFORM BACTERIA WERE DETECTED

Laboratory: MINNESOTA DEPARTMENT OF HEALTH LABORATORY

Date Collected : 01/31/2002 Lab Sample # : 200201938
Date Received : 01/31/2002 Field # : 02-047
Date Analyzed : 02/01/2002 Sample Type : O
Collector Name : Adefuye Adesegun
Collector ID : 5601

Sampling Point : WELL 1 EP

Nitrate + Nitrite Nitrogen, Total : 0.08 mg/l

Date Report Generated 03/25/2002

Elementary School
123 Main Street
ANOKA MN 55303

Date Collected: The date the water sample was collected at your facility.

Collector Name: The person who collected the water sample.

Sampling Point: The location in the water system where the sample was collected.

Contaminant Tested: The contaminant that the water was tested for. In this case, the water was tested for bacteria ("Bacteria Result") and nitrate ("Nitrate + Nitrite, Total"). These are the two most common water tests.

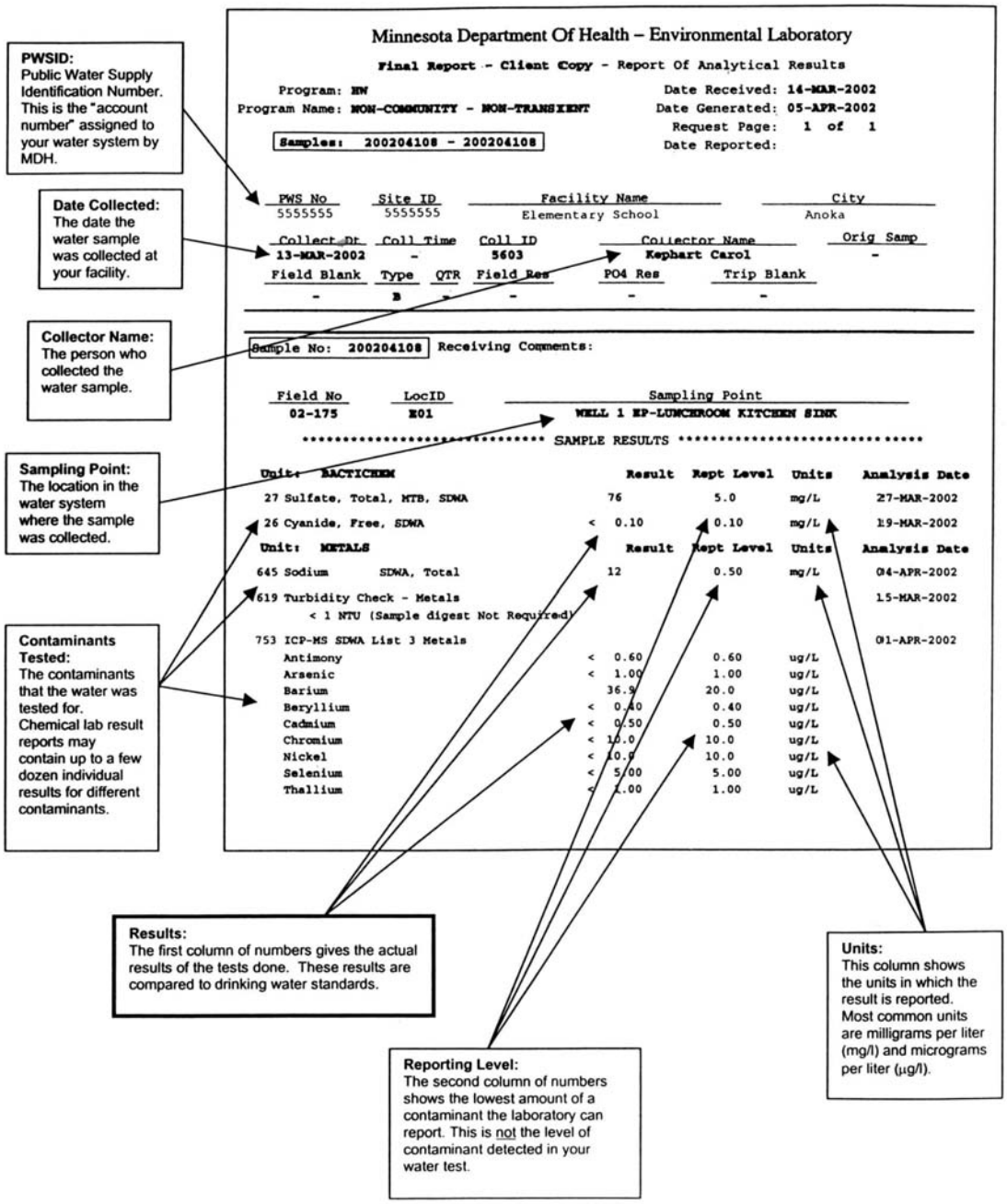
Result: Result of the test(s) done. In this case, no bacteria were found and the nitrate result was 0.08 milligrams per liter (mg/l). In this example, both results meet drinking water standards.

PWSID: Public Water Supply Identification Number. This is the "account number" assigned to your water system by MDH.

* In some cases, your bacteria result will appear on a different form, if it was analyzed by MDH staff in a District Laboratory.

Example Water Test Result Report – Routine Chemical Results

The information given below explains the information provided on routine chemical results.



Minnesota Department Of Health – Environmental Laboratory

Final Report - Client Copy - Report Of Analytical Results

Program: NW
Program Name: NON-COMMUNITY - NON-TRANSIENT
Samples: 200204108 - 200204108

Date Received: 14-MAR-2002
Date Generated: 05-APR-2002
Request Page: 1 of 1
Date Reported:

PWS No	Site ID	Facility Name	City
5555555	5555555	Elementary School	Anoka

Collect Dt	Coll Time	Coll ID	Collector Name	Orig Samp
13-MAR-2002	-	5603	Kephart Carol	-

Field Blank	Type	QTR	Field Res	PO4 Res	Trip Blank
-	B	-	-	-	-

Sample No: 200204108 Receiving Comments:

Field No	LocID	Sampling Point
02-175	E01	WELL 1 EP-LUNCHROOM KITCHEN SINK

SAMPLE RESULTS

Unit: BACTICHEM	Result	Rept Level	Units	Analysis Date
27 Sulfate, Total, MTB, SDWA	76	5.0	mg/L	27-MAR-2002
26 Cyanide, Free, SDWA	< 0.10	0.10	mg/L	19-MAR-2002
Unit: METALS	**Result**	**Rept Level**	**Units**	**Analysis Date**
645 Sodium SDWA, Total	12	0.50	mg/L	04-APR-2002
619 Turbidity Check - Metals < 1 NTU (Sample digest Not Required)				15-MAR-2002
753 ICP-MS SDWA List 3 Metals				01-APR-2002
Antimony	< 0.60	0.60	ug/L	
Arsenic	< 1.00	1.00	ug/L	
Barium	36.9	20.0	ug/L	
Beryllium	< 0.40	0.40	ug/L	
Cadmium	< 0.50	0.50	ug/L	
Chromium	< 10.0	10.0	ug/L	
Nickel	< 10.0	10.0	ug/L	
Selenium	< 5.00	5.00	ug/L	
Thallium	< 1.00	1.00	ug/L	

PWSID:
Public Water Supply Identification Number. This is the "account number" assigned to your water system by MDH.

Date Collected:
The date the water sample was collected at your facility.

Collector Name:
The person who collected the water sample.

Sampling Point:
The location in the water system where the sample was collected.

Contaminants Tested:
The contaminants that the water was tested for. Chemical lab result reports may contain up to a few dozen individual results for different contaminants.

Results:
The first column of numbers gives the actual results of the tests done. These results are compared to drinking water standards.

Reporting Level:
The second column of numbers shows the lowest amount of a contaminant the laboratory can report. This is not the level of contaminant detected in your water test.

Units:
This column shows the units in which the result is reported. Most common units are milligrams per liter (mg/l) and micrograms per liter (µg/l).

Public Notification

If a water supply fails to meet or comply with requirements regarding an applicable maximum contaminant level (MCL), it must notify the public. Additionally, the public water system may need to supply an alternative source of safe drinking water until the problem has been corrected.

A public notice warns all potential users of the water supply that the water has been found to be in violation of the SDWA. The notice must include possible health effects from consuming the water. The notice must also include a location where safe water is available if the system is required to provide an alternate source of water. For NTNC public water supplies, an acceptable method of providing public notification is to post warning signs at all potential drinking water taps. For nonmunicipal public water systems, an acceptable method of providing public notification is to place a notice in a local newspaper or provide notification to each water consumer.

Cross Connections

Cross connection. A direct connection of a potable water source with any system, equipment or fixture that contains nonpotable water.

Backflow. An undesired, reversed flow in a piping system. Backflow can be caused by back-siphonage, backpressure, or a combination of the two.

Back-siphonage backflow occurs when there is a partial vacuum (negative pressures) in a water-supply system, potentially drawing contaminants into a potable water supply. The effect is similar to sipping a soda by inhaling through a straw.

Backpressure backflow occurs when the pressure of the nonpotable system exceeds the positive pressure in the potable water distribution lines. This allows contaminants to be forced back into the potable water system.

Key Points in Cross Connection Control Are:

- Eliminate or protect direct connections by proper backflow preventers between potable and nonpotable systems.
- Design piping systems in the potable water distribution system so that enough water at the desired pressure is always available.
- Maintain the distribution system to minimize breaks. Prevent any new connections to equipment or systems that could allow the entry of contaminants, unless a proper backflow prevention device is provided.
- Maintain all backflow preventers in good working order.
- Be alert to the potential for contamination due to cross connections to plumbing fixtures, equipment, or other systems.

Preventing Backflow

There are several basic ways to prevent or reduce the possibility of backflow in cross connections: air gaps, atmospheric vacuum breakers, hose bibb vacuum breakers, pressure-type vacuum breaker assemblies, double check valve assemblies, dual-check valve with intermediate atmospheric vent, and reduced-pressure backflow prevention assemblies. The most reliable means of preventing backflow is an air gap.

An air gap is a physical separation of the potable and nonpotable systems by an air space—it is the **most** reliable backflow prevention measure. The vertical distance between the supply pipe and the flood-level rim should be two times the diameter of the supply pipe, but never less than one inch. An air gap can be used in situations where potable water runs into a tank, drain, or pipe which is under atmospheric pressure. This type of backflow prevention method cannot be used for a direct connection to a pressurized system.

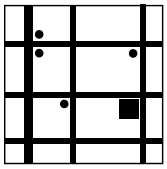
Security

The items listed below may help prevent vandalism and reduce potential safety hazards.

- ✓ Routinely check the facility for any signs of tampering. Items to check include wells, well houses, plumbing, treatment rooms, storage rooms, and the water facility grounds. It is recommended to check the facilities on a **daily** basis, which will allow you to quickly find any problem that has come up since the last check.

- ✓ Consider using locks on all well house doors. Provide locking well caps.
- ✓ Prevent access to other water systems components – such as tanks, towers, treatment equipment, and chemical storage – as much as possible. Limit public access to water system components. Deter entry to these areas with signs labeled "Employees Only" or "Restricted Access." Consult with your local fire department about acceptable ways to lock doors, gates, and windows.

- ✓ Be on the lookout for any suspicious activities or unknown persons around the water system. If a person is unknown, do not hesitate to ask for identification.
- ✓ Provide adequate lighting around the entire facility.
- ✓ If you use water treatment chemicals, make sure that containers purchased or delivered are intact and secure. Use only reliable sources and known contractors. It is a good idea to have a list of contractors and vendors that you may use. Do not accept deliveries from unknown individuals or vendors. It is advisable to have a staff person present during all deliveries.



- ✓ If your water supply is run using a computer system, make sure that system is secure and be on the alert for attempts to disrupt its operation. Also, secure all maps, records, and any other information that is vital to the operation of the water system.
- ✓ If you hire someone from a vendor to work on the water system (plumber, well contractor, etc.) verify that any individuals coming to your facility are employed by that vendor before allowing him or her to do any work.
- ✓ Introduce yourself to local law enforcement to review your security measures and to establish a personal contact (name and phone number).
- ✓ Provide an emergency plan for your facility.

Safety for Small Water Systems

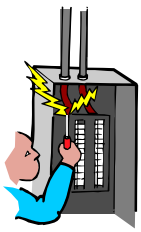
(The following is from the *Ground Water Manual for Small Water Systems.* 1999. The Drinking Water Assistance Program – Montana Water Center, and the Montana Department of Environmental Quality, Permitting and Compliance Division developed this publication.)

Safety is very important for all public water systems, regardless of size. In order for a safety program to be successful, everyone involved in the public water system must participate in the program. Ultimately, the purpose of any safety program is to prevent accidents. Three critical aspects of a safety program are:

1. Identifying unsafe conditions and resolving those conditions,
2. Making personnel aware of unsafe acts, and
3. Holding or attending regular safety training programs.

The vast majority of injuries on water systems jobs are caused by unsafe acts of the person injured. Often, injuries occur when improper or dangerous procedures continue to be used because unsafe conditions went uncorrected. Unsafe conditions can become commonplace in small systems when an operator works alone and does not have coworkers to point out safety concerns. They may also occur if one individual attempts an activity for which more than one person is needed – even if the second person would serve largely as an observer able to summon help if needed.

Unsafe conditions commonly encountered in public water supply systems include:



- **Electrical Hazards** – The bottom line for electrical safety is that only individuals knowledgeable in electrical systems and safety should be working on electrical equipment. Operators who do not work on electrical equipment must be able to recognize the dangers of exposed wires, pooled water near wiring and controls, and corroded wiring.

- **Chemical Hazards** – Chemicals may be flammable, corrosive or toxic. "Right-to-Know" laws require employers to inform employees of the possible health effects resulting from contact with hazardous substances. ***Material Safety Data Sheets*** (MSDS) are provided with all hazardous chemicals purchased and must be made available to all individuals potentially exposed to the chemicals through handling or routine operations. These sheets describe specific materials compatibility, handling precautions, spill responses and hazardous properties of the chemical. The MSDS sheets must be posted in a conspicuous location for easy reference.

- **Chemical Storage and Handling Hazards** – The two important aspects of chemical storage are compatibility and containment. **Compatibility** refers to appropriate storage tank, piping and valve materials, which are intended to be used with the particular chemical. **Containment** refers to the need for protective berms or other means by which chemical spills can be contained for easier clean up. In addition to using appropriate personal protective gear, an operator must obtain and use the proper equipment which allows safe handling and lifting of heavy objects.

- **Flammable Situations** – Chemicals that are flammable require special storage conditions. Liquid chemicals must be carried in safety cans. Flammable liquids and solids must be stored in a separate facility. This is to ensure the chemicals are not accidentally exposed to flammable conditions.

- **Traffic Control in Work Areas** – Safe traffic control procedures are essential, even for small systems. Hazards to workers caused by fast and uncontrolled traffic endanger workers and drivers of other vehicles. Traffic control includes advising motorists and pedestrians of conditions affecting road use around the work site. Advance warning to motorists, signing and traffic guidance are all necessary components of a safety program for projects in streets.

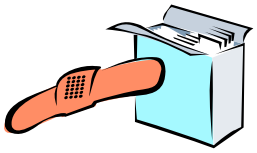
- **Confined Spaces** – A confined space is one in which ventilation may be insufficient to remove dangerous gases or add fresh air. In addition, the size of the confined space opening may make it difficult to remove a suddenly disabled person. Dangerous gases may accumulate in confined spaces; many of which are colorless and odorless so an operator cannot know they are present without specialized testing equipment. **Work must not be done in a confined space without the proper safety equipment and someone trained to run it.** In many situations, a second person is needed to monitor the work of the individual in the confined space so rescue can occur if problems develop. The following is a description of safety procedures to follow when preparing to enter any tank for any reason:

    - Test the atmosphere in the tank for toxic and explosive gases and for adequate oxygen;
    - Provide adequate ventilation;

- All persons entering a tank must wear a safety harness; and,
- One person must be at the tank entrance observing the actions of all people in the tank. An additional person must be readily available to help the person at the tank entrance with any rescue operation.

- **Fire safety** – Fire extinguishers must be available in all locations where fire hazards exist – either through chemical combustion or electrical problems. Make sure they are located in a readily accessible and visible location.

- **First Aid** – An American Red Cross-approved first aid kit must be available in any water-testing laboratory and near any work centers where cuts, abrasions or sprains might occur. Eyewash equipment is necessary near chemical handling facilities – either plumbed into the system or as stand-alone squeeze bottles. These units must be kept clean and in good operating condition.



- **Personal Hygiene and Protective Clothing** – Protective clothing which may be required for general work on water systems include:
  - Hard-toe shoes,
  - Safety goggles for work around chemicals or moving parts,
  - Ear plugs in pump stations,
  - Gloves, and
  - Hard hats.

MSDS sheets will provide information on the hazards associated with each chemical and precautions that must be taken when handling the chemical.

- **Lifting** – Evaluate the weight of any object and do not lift more than can be safely carried. Hand trucks, dollies or other equipment must be used when items are too heavy to carry alone and help is not readily available.

Notes