Environmental Health Division
625 North Robert Street
P.O. Box 64975
St. Paul, MN 55164-0975
651-201-4600 or 800-383-9808
health.wells@state.mn.us

DEPARTMENT OF HEALTH

Home Water Treatment

Most Minnesotans do not need to install water treatment at home to protect their health. If you know your drinking water is contaminated or you are concerned about the color, taste, or odor of your water, first try to remove the source(s) of contamination or replace the contaminated water supply with a safer supply. If this is not possible, then home water treatment may be appropriate. Use this resource to help decide if home water treatment makes sense for you and what treatment options may be best for you. **Contaminant-specific information starts on page 3.**

Step 1: Know where your drinking water comes from

- **If you get your drinking water from a public water system**, your water system and the Minnesota Department of Health (MDH) regularly test the water for over 100 different contaminants and make sure it meets all Safe Drinking Water Act standards. You can learn more about your water quality by reading your water system's annual report (called a Consumer Confidence Report [CCR]). You can request the report from your water system or Search for your CCR (https://mnccr.web.health.state.mn.us/index.faces).
- **If you get your drinking water from a private well,** you are responsible for regularly testing your well water to make sure it is safe for drinking and cooking. Learn more about testing recommendations and how to test your water at Water Quality/Well Testing (health.mn.gov/wellwater).

Step 2: Think about why you want water treatment

Knowing what you want from water treatment will help you choose the best treatment option. Some common reasons people think about water treatment for their home:

- They do not like the way their water tastes, smells, looks, or feels.
- They are concerned about a specific contaminant (such as lead, arsenic, or nitrate) in their water. Beware of Water Treatment Scams (health.state.mn.us/communities/environment/water/factsheet/beware.html).

Step 3: Select a water treatment option

There are many water treatment options. Deciding what option is best for you depends on what you want from your water treatment. This information sheet gives an overview of water treatment considerations and options. You may need to do additional research or contact a water treatment professional to find the best option for you. Below are some key questions to consider.

What contaminant would you like to remove?

Select a treatment unit certified by NSF, Underwriter's Laboratory (UL), or Water Quality Association (WQA) to remove the contaminant(s) you are concerned about, if a certification is available. These organizations do not certify treatment units for all contaminants. In this case, you may need to contact a water treatment professional.

- Search for NSF Certified Drinking Water Treatment Units, Water Filters (http://info.nsf.org/Certified/DWTU/)
- Residential Drinking Water Standards (www.nsf.org/services/by-industry/water-wastewater/residential-water-treatment/residential-drinking-water-treatment-standards)
- Find WQA-Certified Water Treatment Products (https://www.wqa.org/find-products#/)

No single treatment unit can remove all contaminants in water. Depending on your water quality, or if you want to remove more than one contaminant, you may need to combine several treatment units into a treatment system.

Do you want to treat all of the water in your home or just drinking water?

There are two main types of home water treatment:

- **Point-of-use (POU)** units treat water at one faucet or one location. Examples include pour-through pitchers or units that sit on the counter, attach to a faucet, are part of a refrigerator water/ice dispenser, or are under the sink. POU is a good option for treating only the water you use for drinking and cooking.
- **Point-of-entry (POE)** units are installed on the water line as it enters the home. POE units treat all of the water in your home.

What is your budget?

Prices vary widely for treatment options—anywhere from less than twenty dollars to thousands of dollars. Things to consider for your water treatment budget include whether you want to treat just your drinking water at one tap or all of the water in your home, maintenance costs, and whether you will install the treatment yourself or hire a professional. Your household may qualify for one of the following loans (which you have to pay back) or grants (which you do not have to pay back) to help pay for water treatment.

- **AgBMP Loan Program** provides low interest loans to farmers, rural landowners, and agriculture supply businesses. Contact your local Soil and Water Conservation District or see Agriculture Best Management Practices (BMP) Loan Program (www.mda.state.mn.us/agbmploan).
- **Single Family Housing Repair Loans and Grants** provide low interest loans for homeowners with income below 50 percent of the area's median income and grants for people over the age of 62 years. See Single Family Housing Repair Loans and Grants (https://www.rd.usda.gov/programs-services/single-family-housing-repair-loans-grants).
- **Fix Up Program** provides fixed interest rate loans to homeowners. Go to Minnesota Housing (www.mnhousing.gov) and click on "Homebuyers & Homeowners—Improve Your Home".

Step 4: Install water treatment

You can purchase and install a treatment unit on your own, or you can work with a water treatment professional. Search for water treatment professionals in your telephone book, online, or at Find Water Treatment Providers (www.wqa.org/find-providers). If you work with a treatment professional, make sure they are a licensed plumber or licensed water conditioning contractor by using the Minnesota Department of Labor and Industry's License Lookup (https://secure.doli.state.mn.us/lookup/licensing.aspx). Here are some Recommended Questions to Ask a Water Treatment Professional (https://www.wqa.org/improve-your-water/questions-to-ask).

Step 5: Test and maintain water treatment

After installing treatment, test the treated water to make sure the treatment is working. Then, follow the manufacturer's recommendations for cleaning and maintenance. All water treatment units require regular maintenance to work properly. Maintenance can include changing filters, disinfecting the unit, backwashing, or cleaning out mineral build-up (scale). **Water treatment units that are not properly maintained will lose their effectiveness over time. In some cases, unmaintained units can make water quality worse and make you sick.**

Resources

- Centers for Disease Control and Prevention. A Guide to Drinking Water Treatment Technologies for Household Use (https://www.cdc.gov/healthywater/drinking/home-water-treatment/household_water_treatment.html).
- MDH. A - Z List of Contaminants in Water (health.state.mn.us/communities/environment/water/contaminants/index.html).
- MDH. Home Water Softening (health.state.mn.us/communities/environment/water/factsheet/softening.html).
- MDH. Water Quality/Well Testing (health.mn.gov/wellwater).
- NSF. Drinking Water Filters, Testing and Treatment (www.nsf.org/consumer-resources/water-quality/water-filters-testing-treatment).
- The Private Well Class. Water Treatment Solutions (privatewellclass.org/lesson-10).

Water treatment units and the contaminants they treat

This table shows the most common home water treatment units and the contaminants the units can remove. Learn more about the treatment units and cost estimates on the following pages.

● = designed to fully or partially remove O = may partially remove	Adsorptive media filtration[1]	Aeration and filtration	Anion exchange[1]	Carbon filter [1]	Continuous chlorination and filtration	Distillation	Oxidizing media filtration	Ozonation and filtration	Reverse osmosis	Ultraviolet (UV) disinfection	Water softening
Color, taste, or odor issues		●		●	●	●	●	●	●		
Ammonia		●			O						
Arsenic[2]	●	O	●		●	●	●	●	●		
Bacteria[3]					●	●		●	●	●	
Calcium						●			●		●
Chloride						●			●		
Chlorine		●		●							
Copper						●			●		●
Fluoride	●		●	●		●			●		
Hydrogen sulfide		●		●	●		●	●			
Iron		●		●	●	●	●	●	●		●
Lead				●		●			●		
Magnesium						●			●		●
Manganese		●		●	●	●	●	●	●		●
Methane		●									
Nitrate			●			●			●		
Nitrite		O	●		●	●		●	●		
Other dissolved solids (ODS)						●			●		
Pesticides and other synthetic organic compounds (SOCs)				●		●			●		
Perfluoroalkyl substances (PFAS)				●					●		
Radium		O			O	●	●		●		●
Radon		●		●							
Selenium	●		●			●			●		
Sodium						●			●		
Sulfate	●		●			●			●		
Trichloroethylene (TCE)		●		●					●		
Trihalomethanes (THMs)		●		●					●		
Uranium	●		●			●			●		
Vinyl chloride		●							●		
Viruses[3]					●	●		●	●	●	
Volatile organic compounds (VOCs)		●		●					●		

[1] The substances that these technologies reduce or remove depends on the filter media or resin.

[2] There are two types of arsenic in Minnesota groundwater: arsenic(III) and arsenic(V). Pre-oxidation (chlorination, aeration, or ozonation) may be needed before water treatment to make sure the treatment removes the type of arsenic present in your water. Sulfate levels above 100 parts per billion may also affect what type of water treatment will remove arsenic. MDH recommends working with a water treatment professional to make sure your treatment unit/system effectively removes arsenic.

[3] If you are using a filter, make sure your filter has the necessary pore size for the bacteria or virus you are trying to remove.

Summary of home water treatment options

Treatment option	Description	Pros and cons	Point-of-use cost[4] estimate	Point-of-entry cost[4] estimate	Designed to fully or partially remove
Adsorptive media filtration	A charged media bed causes ions of the opposite charge (contaminants) to be pulled out of the water and attach to the media.	**Pros**: Produces very little wastewater. Does not require adding chemicals to the water. **Cons**: Treatment effectiveness may depend on the pH of the water.	*Initial*: $300 to $700 *Maintenance*: $300 to $500 every 6 to 12 months	*Initial:* $2,400 to $4,500 *Maintenance:* $700 to $900 every year	Depends on the type of media. The two most common media are activated alumina and iron-based. Activated alumina media removes arsenic, fluoride, selenium, sulfate, uranium. Iron-based media removes arsenic. It may not be as effective at removing arsenic if there is also phosphate in the water.
Aeration and filtration	An aerator brings oxygen into the water. The oxygen helps change dissolved contaminants into solid particles. The solid particles are large enough to be filtered out of the water. Some types of aeration cause VOCs and dissolved gases to evaporate out of the water.	**Pros**: Does not require adding chemicals to the water. **Cons**: Water with too much oxygen can be corrosive and corrode your pipes; this may be a health concern if you have copper or lead pipes.	N/A[5]	*Initial*: $800 to $4,000 *Maintenance:* Extra water to backwash; replacement of the filter media.	Color, taste, or odor issues Ammonia, chlorine, hydrogen sulfide, iron, manganese, methane, other dissolved gases, radon, TCE, THMs, vinyl chloride, VOCs *May partially remove:* arsenic (only if there is also high iron), nitrite, radium.

[4] Point-of-use and point-of-entry cost estimates are based on quotes obtained in 2017 and research in 2018; actual costs may vary. In general, the low-end cost is for a treatment unit the homeowner installs; the high-end cost is for a treatment unit installed by a water treatment professional.
[5] N/A: Treatment technology is not typically available in this type.

Treatment option	Description	Pros and cons	Point-of-use cost[4] estimate	Point-of-entry cost[4] estimate	Designed to fully or partially remove
Anion exchange	Anion exchange removes dissolved minerals in the water. The owner adds sodium chloride or potassium chloride (salt), which replaces negatively charged minerals in the water.	**Pros**: Sodium chloride and potassium chloride are safe to handle and easy to buy. **Cons**: Anion exchange may affect how corrosive your water is and can corrode your pipes; this may be a health concern if you have copper or lead pipes. If treatment is not maintained properly, high concentrations of the contaminant can be dumped back into the water. Salt use can negatively affect the environment.	N/A[5]	*Initial*: $1,500 to $2,500 *Maintenance*: $700 to $900 every 8 to 10 years	Depends on the resin. Resins may be certified to remove arsenic, fluoride, nitrate, nitrite, selenium, sulfate, uranium.
Carbon filter (This includes granular activated carbon filters—GAC)	Contaminants accumulate on the filter while water passes through.	**Pros**: Point-of-use carbon filters are inexpensive and easy to find and use. **Cons**: Harmful bacteria can grow if you do not regularly maintain and replace the filter according to the instructions. If the filter is not replaced according to the instructions, it can become saturated and begin to release contaminants into the water.	*Initial*: $10 to $100 *Maintenance*: $10 to $100 every few months to replace the filter.	*Initial:* $500 to $3,000 *Maintenance:* Extra water to backwash or adding a disinfectant to kill bacterial growth. Replacement of the filter.	Color, taste, or odor issues Contaminant removal depends on the filter's pore size. Some filters are certified to remove chlorine, fluoride, hydrogen sulfide, iron, lead, manganese, radon, TCE, THMs and other disinfection by-products, VOCs. An MDH study showed that GAC filters are effective at removing PFAS. *POE* units may also treat pesticides and other SOCs.

Treatment option	Description	Pros and cons	Point-of-use cost[4] estimate	Point-of-entry cost[4] estimate	Designed to fully or partially remove
Continuous chlorination and filtration	The owner adds chlorine bleach (a disinfectant that kills bacteria and viruses) to a holding tank. A pump feeds chlorine into the water, which helps change dissolved contaminants into solid particles. The solid particles are large enough to be filtered out of the water.	**Pros**: Use of chlorination helps prevent microbial growth throughout the plumbing system. **Cons**: Chlorination systems are complex, may take up a lot of space, and require frequent maintenance and monitoring. May create chemicals (by-products) in the drinking water. If the levels are high enough, by-products can cause long-term health issues. An additional carbon filter may be needed to remove the chlorine taste from drinking water.	N/A[5]	*Initial*: $500 to $2,500 *Maintenance:* Cost of bleach; extra water to backwash; replacement of the filter media.	Color, taste, or odor issues Arsenic (only if there is also high iron), bacteria, hydrogen sulfide, iron, manganese, nitrite, viruses *May partially remove:* ammonia, radium.
Distillation	Distillers boil water, which makes steam. The steam rises and leaves contaminants behind. The steam hits a cooling section, where it condenses back to liquid water.	**Pros**: Removes a wider variety and greater amount of contaminants than many other treatment options. Kills 100% of bacteria, viruses, and pathogens, so you can still drink your water during boil water advisories or if your well becomes contaminated. **Cons**: Heating the water to create steam can be expensive. Water may taste 'flat' because oxygen and minerals are reduced.	*Initial*: $300 to $1,200 *Cost consideration*: Energy cost to boil water.	N/A[5]	Color, taste, or odor issues Arsenic, bacteria, calcium, chloride, copper, fluoride, iron, lead, magnesium, manganese, nitrate, nitrite, ODS, some pesticides and other SOCs, radium, selenium, sodium, sulfate, uranium, viruses

Treatment option	Description	Pros and cons	Point-of-use cost[4] estimate	Point-of-entry cost[4] estimate	Designed to fully or partially remove
Oxidizing media filtration	A media bed changes dissolved contaminants into solid particles. The solid particles are large enough to be filtered out of the water.	**Pros**: More effective than other oxidation and filtration methods at removing iron, manganese, arsenic, and radium. Does not require a continuous chemical feed. **Cons:** Requires periodic regeneration of the media (backwashing or soaking with a chemical solution to make the media work again). Regeneration can be messy, and the chemicals can be harmful, so they must be handled and stored carefully.	N/A[5]	*Initial*: $1,500 to $3,000 *Maintenance*: Extra water to backwash; cost for chemicals; replacement of the filter media.	Color, taste, or odor issues Arsenic (only if there is also high iron), hydrogen sulfide, iron, manganese, radium
Ozonation and filtration	Ozone (a disinfectant that kills bacteria and viruses) is generated using electricity and then injected into the water. The ozone changes dissolved contaminants into solid particles. The solid particles are large enough to be filtered out of the water.	**Pros**: Does not require handling of chemicals. Ozone rapidly degrades, so no ozone reaches the consumer through the drinking water. **Cons**: Uses a lot of energy.	N/A[5]	Call a water treatment professional to get a quote.	Color, taste, or odor issues Arsenic (only if there is also high iron), bacteria, hydrogen sulfide, iron, manganese, nitrite, viruses
Reverse osmosis (RO)	RO uses energy to push water through a membrane with tiny pores. The membrane stops many contaminants while allowing water to pass through.	**Pros**: Removes a wider variety and greater amount of contaminants than many other treatment options. **Cons**: Can create a lot of wastewater. May require pretreatment to prevent the membrane from getting clogged.	*Initial*: $300 to $1,500 *Maintenance*: $100 to $200 every 1 to 2 years	*Initial:* $5,000 to $12,000 *Maintenance:* $250 to $500 every 1 to 2 years	Color, taste, or odor issues Arsenic, bacteria, calcium, chloride, copper, fluoride, iron, lead, magnesium, manganese, nitrate, nitrite, other dissolved solids, pesticides and other SOCs, PFAS, radium, selenium, sodium, sulfate, other metals, TCE, THMs, uranium, vinyl chloride, viruses, VOCs

Treatment option	Description	Pros and cons	Point-of-use cost[4] estimate	Point-of-entry cost[4] estimate	Designed to fully or partially remove
Ultraviolet (UV) disinfection	A UV lamp shines UV rays through the water. The UV rays kill bacteria, viruses, and other pathogens.	**Pros**: Does not require adding chemicals to the water. UV disinfection can be more effective than chlorination. **Cons**: May require pre-filtration if your water has some cloudiness (turbidity is above 1 NTU).	*Initial*: $150 to $300 *Maintenance*: $50 to $100 per year	*Initial:* $250-$800 *Maintenance:* about $100 per year	Bacteria, viruses
Water softening (cation exchange)	Water softeners remove dissolved minerals in the water. The owner adds sodium chloride or potassium chloride (salt), which replaces positively charged minerals in the water. This makes the water softer. Water softeners are sometimes installed to treat only some water in the home. The water softener may not be connected to cold water plumbing or kitchen faucet plumbing.	**Pros**: Sodium chloride and potassium chloride are safe to handle and easy to buy. Water softening is the cheapest option for removing hardness (calcium and magnesium). **Cons**: Water softening with sodium chloride adds sodium to the water, which may be a health issue for some people. Water softening may affect how corrosive your water is and can corrode your pipes; this may be a health concern if you have copper or lead pipes. Salt use can negatively affect the environment.	N/A[5]	*Initial*: $200 to $3,000 *Maintenance*: $50 to $300 per year for salt	Calcium, copper, iron, magnesium, manganese, radium

To obtain this information in a different format, call 651-201-4600.
Printed on recycled paper.
4/4/2019*R*