

Treating Water With Less Waste

Reverse Osmosis Systems



Home or business water treatment systems that use reverse osmosis (RO) technology at the point where the water is drawn—referred to as point-of-use systems—are an effective solution for reducing harmful contaminants from drinking water. However, a typical point-of-use RO system sends five gallons of water or more down the drain for every gallon of treated water it produces. RO systems that have earned the U.S. Environmental Protection Agency’s (EPA’s) WaterSense® label can reduce water wasted during the RO treatment process while still providing the water quality that consumers demand. This document describes the characteristics and benefits of WaterSense labeled RO systems and provides tips for successful use and maintenance of these systems to maximize performance and water savings.



Background

Reverse osmosis is the process by which pressure forces water through a membrane that blocks particles and contaminants while letting clean water pass through. RO creates a stream of treated water and a stream of concentrated “reject” water (see Figure 1). An RO system can effectively reduce drinking water contaminants such as lead, volatile organic compounds (VOCs), per- and polyfluoroalkyl substances (PFAS), arsenic, bacteria, and viruses.

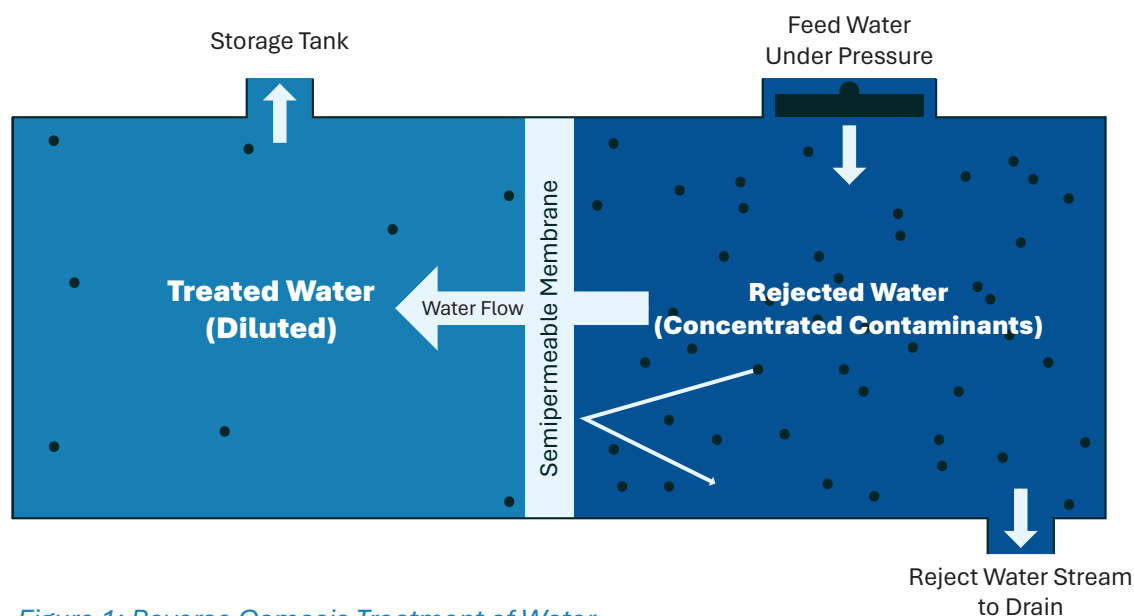


Figure 1: Reverse Osmosis Treatment of Water

A point-of-use RO system is a water treatment device that is connected to a single fixture (e.g., at the kitchen sink) that uses the reverse osmosis process described above to remove contaminants from the water supplied to that fixture (see Figure 2 on page 3). Point-of-use RO systems are typically installed in residential settings but can also be found in commercial office spaces or kitchens.

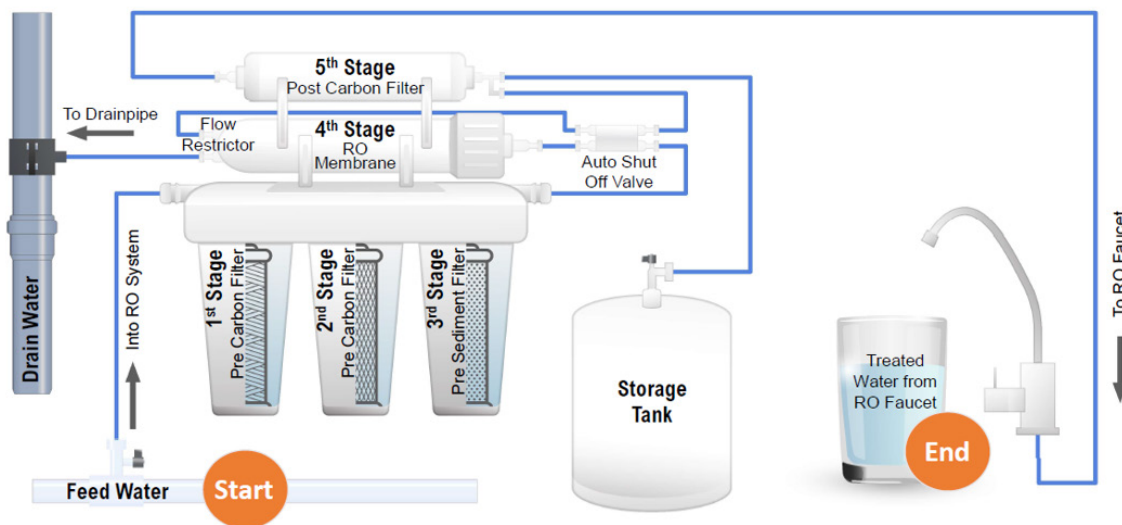
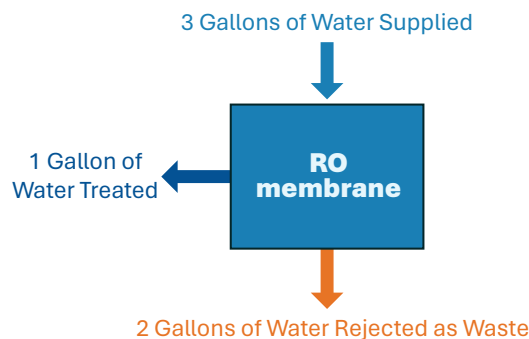


Figure 2. Typical Under-Sink Point-of-Use RO System Configuration

While RO systems can improve water quality, they can also waste a significant amount of water in the process. For example, a typical point-of-use RO system will generate five gallons or more of reject water for every gallon of treated water it produces. In recent years, membrane technology has improved, and some systems can operate more efficiently, sending just one or two gallons of water down the drain for every gallon of treated water produced.

RO efficiency ratings are determined by the percentage of water going into the system that becomes available to the user as treated water under typical operating conditions. So a system that sends two gallons of water down the drain for every gallon of treated water produced would have an efficiency rating of 33 percent, meaning that 33 percent of the water that goes into the system becomes available as treated water and 67 percent goes down the drain (see Figure 3). Therefore, a higher efficiency rating indicates a more efficient system.



$$\frac{1 \text{ gallon of treated water}}{3 \text{ gallons of water supplied}} = 0.33 \times 100 = 33\% \text{ efficiency}$$

Figure 3. Representation of RO System Water Use and Efficiency

WaterSense Labeled RO Systems

Because the water efficiency levels of point-of-use RO systems varies so much, EPA established a WaterSense specification to help consumers identify the more efficient models, while ensuring the water quality that consumers expect. An RO system that bears the WaterSense label is required to have an efficiency rating of at least 30 percent and meet EPA’s performance criteria. Consumers looking for a new RO system can select WaterSense labeled models that are significantly more water-efficient than a typical point-of-use RO system. All WaterSense labeled products are independently certified to use less water and perform as well or better than standard models.

A properly designed, installed, and maintained WaterSense labeled RO system offers many environmental and economic benefits:

- **Reduce water waste.** While a typical system sends five gallons of water or more down the drain for every gallon of treated water it produces, a WaterSense labeled RO system will send no more than 2.3 gallons of water down the drain for every gallon of treated water it produces.
- **Ensure performance.** All WaterSense labeled RO systems are certified to industry standards and must meet the same contaminant removal requirements as traditional point-of-use RO systems.
- **Improve water efficiency and save money.** While RO systems increase water use overall compared to using tap water or other filter technologies for water treatment, selecting a WaterSense labeled RO system to replace an existing RO system or instead of a typical RO system during a new purchase can reduce water use for the average household by more than 3,100 gallons of water per year. That's equal to the amount of water needed to take nearly 200 showers. Reduced water use can save the average household nearly \$50 per year in water and wastewater costs compared to a traditional point-of-use RO model.



Selecting an RO System

When considering a point-of-use RO system, ensure that the system is the right fit to treat your household water:

Determine whether RO is the right treatment method to address your needs. A simple water filter on your tap or filtered water pitcher may be all you need. If you determine that RO is right for your home, do not oversize the system. A point-of-use system should be sufficient for most household applications.

Understand your RO system options. Some systems have a tank, typically under the sink, to store treated water, so you can have it on-demand; tankless RO systems take up less space, but they might require a booster pump or take a little longer to fill a glass while the water passes through the RO membrane. RO systems can be under the sink or countertop models:

- Under-sink models are the most common type of point-of-use RO system. They are typically installed under a kitchen sink and are plumbed in, drawing water from the supply line before it

Finding the Right Fit for Household Water Treatment

The *WaterSense Water Treatment Selection Guide* helps you determine the right water treatment technology to address your drinking water quality concerns, as well as your needs for maintenance and water efficiency. Review the guide at www.epa.gov/watersense/point-use-reverse-osmosis-systems.

enters the faucet. Most under-sink models direct treated water to a storage tank where it can be stored and drawn from at any point. Tankless models provide treated water on-demand, typically with the assistance of a booster pump.


- Countertop models are less common, not plumbed in, and may be more appropriate in homes with temporary residents or spatial limitations. Some countertop systems are fitted directly to the kitchen faucet outlet and draw water from the faucet via a diverter, while other models can be self-contained units that draw water from a reservoir that must be filled by the user.

Make an informed selection. Choose an RO system that meets your specific treatment needs based on the following criteria:

- **Contaminant Reduction:** While RO is an effective method for removing several types of contaminants, not all RO systems remove every possible contaminant. Manufacturers are required to provide a performance data sheet, which includes detailed information on the systems’ efficiency rating and contaminants the system is capable of removing. Review the table on the product packaging and/or performance data sheet to identify which contaminants the system has been certified to remove. Select a system that has been certified to remove the specific contaminant(s) you are looking to treat. Common contaminants of concern include lead, arsenic, PFAS, and nitrate.
- **Daily production rate (DPR):** The DPR is the amount of treated water an RO system can produce in a day under specific test conditions. Ensure that the DPR rate meets your household drinking and cooking water needs.
- **Water efficiency:** Select a WaterSense labeled RO system to make sure you’re getting one of the most water-efficient RO systems on the market.

Product Packaging Summary Table

EPA requires all WaterSense labeled RO systems to include a summary table on product packaging and/or other point-of-purchase materials that summarizes the system’s water efficiency, daily production rate, and ability to remove certain priority contaminants. Consumers can use this table to understand the system’s water use and to confirm which contaminants the system can remove from their water. An example summary table is included below.

Water Efficiency and Performance at a Glance			
<i>This system has been tested according to NSF/ANSI 58 for daily production rate, efficiency, and contaminant reduction. A system without verified reduction claims for a listed contaminant has not been verified to remove that contaminant under NSF/ANSI 58.</i>			
Daily Production Rate (DPR)			
16.4 gallons per day			
Efficiency and Water Use			
This system has a 32 percent efficiency rating in the production of treated water. Efficiency rating means the percentage of the water going into the system that becomes available to the user as reverse osmosis treated water. This means that the system will send 2.1 gallons of water down the drain for every gallon of treated water it produces.		<p>2.1:1</p> <p>Waste-to-Treated Water Ratio</p>	
Contaminant Reduction			
Contaminant	Is this system verified to remove the listed contaminant?		
	YES	If yes, what is the verified reduction?	NO
Total Dissolved Solids (TDS)	✓	97%	
Arsenic (Pentavalent) at 50 parts per billion	✓	94%	
Chromium (Hexavalent)	✓	71%	
Chromium (Trivalent)	✓	73%	
Lead	✓	98%	
Nitrate/nitrite			✓
Total Per- and Polyfluoroalkyl Substances (PFAS)	✓	99%	
More Information on System Claims			
All contaminants reduced by this system are listed in the performance data sheet. Scan the QR code or visit (company website) to view the system’s performance data sheet.			
			

RO System Use and Maintenance

Proper use and maintenance are critical to ensure water quality and effective RO system function. A well-maintained RO system can last 15 years.

Water Use

Point-of-use RO systems are designed to treat water for drinking and cooking; other water uses within a home (e.g., clothes washing, toilet flushing, bathing) do not require such high-quality water. Therefore, using an RO system to treat water for non-consumption purposes can waste more water. To reduce water waste even further, consider installing a retrofit kit to capture or redirect the reject water created during the RO treatment process, which can then be used for non-consumption tasks such as laundry, watering plants, or mopping floors.

Storage Tank

To maintain water quality inside the tank, drain the storage tank periodically—about every two weeks. Draining the tank also helps the membrane maintain pressure required to remove contaminants. Many manufacturers also recommend sanitizing your system's storage tank annually. Consider contacting a service provider to have your system sanitized to reduce the risk of bacteria growth in the system.

Filter and Membrane Replacement

Your system may require maintenance if it shows signs of low production, low water pressure, or unexpected taste or odor in the treated water. Over time, soluble and particulate matter will collect on the membrane surface, reducing system efficiency and contaminant removal. Membranes and filters should be replaced according to the manufacturer's product maintenance instructions. In most cases, an RO system will require pre-filter replacement every six months and RO membrane replacement every one to five years, depending on local water quality and use. Filter replacement ensures the system will continue to perform and helps sustain the life of the RO membrane, while membrane replacement can ensure the system performs efficiently and produces treated water at a satisfactory rate and quality.



Automatic Shutoff Device Replacement

Automatic shutoff devices are an important water-saving component installed in WaterSense labeled and other RO systems with a storage tank. This device shuts off the flow of incoming water when the storage tank fills to a certain capacity, thereby stopping the treatment process and preventing the tank from overflowing, thus reducing water waste. A shutoff device can fail or malfunction and periodically may require replacement. If you notice water continually being discharged to the drain, it may be a sign that the shutoff device needs to be replaced. Review shutoff replacement instructions as soon as a malfunction is detected to avoid wasting water and money.

For more information about WaterSense labeled point-of-use RO systems, visit www.epa.gov/watersense/point-use-reverse-osmosis-systems.

To learn more about WaterSense, visit www.epa.gov/watersense.

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