Tech Brief

A NATIONAL DRINKING WATER CLEARINGHOUSE FACT SHEET

Point-of-Use/Point-of-Entry Systems (POU/POE)

by **Z. Michael Lahlou, Ph.D.**, Technical Assistance Consultant

Summary

Numerous households use point-of-use/point-of-entry (POU/POE) systems primarily to deal with aesthetic concerns, such as taste and odor. These treatment devices are installed just as their name implies—at the point where water enters a household or where it is used, such as a faucet. In certain situations, however, using POU/POE systems to provide safe drinking water to a system's customers is not an individual's choice, but that of the water system cooperating with regulatory authorities. Therefore, this "Tech Brief" only discusses POU/POE treatment options that meet Safe Drinking Water Act (SDWA) water quality requirements.

What is the role of POU/POE systems?

Some small water systems find complying with U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) requirements difficult. Installing expensive treatment technologies may be the largest obstacle for these systems. In many cases, obtaining water from some other source may not be an option. In these situations, POU/POE water treatment systems may provide a low-cost alternative to centralized water systems.

Water system personnel can install POE treatment units at individual households where water lines enter the home, alleviating the expense of treating large amounts of water at a central facility. An even less expensive alternative is the POU system, as these systems only treat the water at an individual tap.

POU/POE systems are used to control a wide variety of contaminants in drinking water and often use the same technology concepts employed in centralized treatment—but at a much smaller scale. This technology is applied to reduce levels of organic contaminants, control turbidity, fluoride, iron, radium, chlorine, arsenic, nitrate, ammonia, microorganisms (including cysts) and many other contaminants. Aesthetic factors, such as taste, odor, or color, can be improved with POU/POE treatment.

In addition to treating raw water, POU/POE systems can be used to treat finished water that may have degraded during distribution or storage. They insure that susceptible consumers, such as the very young or immunocompromised, receive safe drinking water.

POU/POE can save many small communities money where individual households have private wells. The community then does not have to build a treatment plant or install and maintain water distribution mains. Many states, however, have concerns about POU/POE treatment devices, such as:

- how well the units treat drinking water,
- the potential health risk posed by not treating all the water in the house, and
- water system officials' ability to properly monitor and maintain the equipment.

What regulations affect POU/POE systems?

The 1996 SDWA lists POU/POE systems as options for compliance technologies. When a water system uses this technology to comply with a National Primary Drinking Water Regulation (NPDWR) the SDWA identifies requirements that must be met. The SDWA states the public water system or a person under contract with the public water system shall own, control, and maintain the POU/POE system to ensure proper operation, maintenance, and compliance. The act also states that the treatment mechanism should be equipped with mechanical warnings that automatically notify customers of operational problems.

Other conditions in the SDWA include: "If the American National Standards Institute has issued product standards applicable to a

Technology	Some Contaminants Removed	Initial Cost	Operating Cost	Operating & Maintenance Skills
Chlorine	Microbial	$	$	$
UV, Ozone	Microbial	$$	$	$$
Cartridge Filter	Protozoa Bacteria	$	$ to $$	$
Reverse Osmosis	Microbial ,Inorganic Chemicals and Metals Radium, Minerals, Some Organic Chemicals	$$	$$$	$$$
Distillation	Microbial,Inorganic Chemicals and Metals, Minerals, Some organic Chemicals, Radium, Uranium	$$	$$	$
Activated Carbon	Organic Chemicals, Radon, Odors (solid block can filter protozoa and some bacteria)	$$	$$ to $$$	$
Packed Tower Aeration	Radon, Volatile Organic Chemicals, Tastes, Odors	$$	$	$$$
Ion Exchange	Inorganic Chemicals, Radium,Nitrate	$$	$$ to $$$	$$
Activated Alumina	Arsenic, Selenium, Fluoride	$$$	$$$	$$$

Table 1: Summary of POE/POU Systems and Costs (NSF, 1999)

$ Low $$ Moderate $$$ High

specific type of POE/POU treatment unit, individual units of that type shall not be accepted for compliance with a MCL or treatment technique unless they are independently certified in accordance with such standards."

POU devices are listed as compliance technologies for inorganic contaminants, synthetic organic contaminants, and radionuclides. POU devices are not listed for volatile organic contaminants because they do not address all routes of exposure.

What are the types of POU/POE systems?

No single type of residential water treatment system is available to remove all water quality problems. Therefore, selection of one or more technologies may be necessary to solve multiple water quality problems. The following is a short summary of different types of POU/POE available (see also **Table 1**). Additional information and guidance is available from manufacturers, distributors, and public health agencies to help select the appropriate treatment technologies to remove specific water contaminants from water.

Filters

Water passes through the filter media (usually in a cartridge in smaller units), which either adsorbs or physically screens various contaminants. Common filter media include:

- Granular activated carbon (GAC) is used for taste and odor control and to remove radon and regulated organic compounds.
- Solid block carbon treats the same contaminants as GAC, but also to removes lead, asbestos, various bacteria, cysts, and sediment particulates.
- Ceramic or synthetic fiber microfilters treat various bacteria, cysts, and sediment particulates.
- Activated alumina treatment is most often used for fluoride, selenium, silica, and arsenic removal.

Reverse Osmosis

Water passes through a synthetic, semi-permeable membrane that filters all pathogens and most organic and inorganic contaminants. Reverse osmosis units must have a means of discharging filtered matter to a drain. The discharge line should be installed with an air gap so a cross-connection between wastewater and drinking water will not occur.

Distillation

Distillers heat water in one chamber and turn it into steam. The steam then passes into another chamber where it is cooled and condensed to a liquid. Distillation can effectively remove microorganisms, dissolved minerals, metals, nitrates, and some organic contaminants. Distillation units require a dependable supply of electricity and usually produce only small amounts of drinking water.

Ion Exchange

Ion Exchange, commonly known as water softening, is used to treat all household potable drinking water. Ions of either sodium or potassium, stored in the softener's "resin bed" are exchanged for ions of the calcium and magnesium hardness minerals. Ion exchange can be used for de-alkalization and to remove iron and manganese, heavy metals, some radioactivity, nitrates, arsenic, chromium, selenium, and sulfate.

Disinfection and Oxidation

Oxidizing chemicals, such as chlorine and ozone, are added to water through a feed system that controls the concentration and allows appropriate contact time. These chemicals break down organic contaminants and destroy pathogens.

Ultraviolet light (UV) is a popular disinfection method in combination with other treatment techniques. UV uses rays of ultraviolet light to deactivate pathogens. UV light damages a pathogen's DNA and prevents it from reproducing. One of the major advantages of UV disinfection is that it disinfects without the addition of chemicals; therefore, it does not generate taste, odor, or chemical by-products.

Air Stripping or Aeration

Air stripping has been used in POE systems to remove volatile organic compounds, hydrogen sulfide, and radon from water. Air stripping is a treatment method that exposes water to air. This treatment process removes or "strips" volatile organic contaminants from groundwater as air is forced through the water, causing the compounds to evaporate. GAC alone can remove volatile organics but can only be operated for short periods before the carbon has to be replaced. For these applications, it is important to vent gases adequately to avoid creating an air pollution hazard inside the home.

POU/POE Operation and Maintenance

Selecting POU/POE systems does not eliminate the need for evaluating treatment efficiency before the units are installed. For systems that employ cartridges (e.g., GAC columns or activated alumina), source water pilot testing may be necessary to develop valid estimates of the unit's service life.

Effective operation, maintenance, and monitoring programs are especially significant for POU/POE systems. Many homeowners assume their systems will perform properly once installed and do not understand the level of effort required to ensure proper operation. For this reason, when POU/POE systems are installed for regulatory purposes, water utilities or regulatory agencies must provide programs for long-term operation, maintenance, and monitoring.

Proper installation is the first step in effective long-term operation and maintenance (O&M) of POU/POE systems. Experienced contractors or installers whose products conform to applicable plumbing codes should be the only personnel who install the units. Qualified installers:

- carry liability insurance for property damage during installation,
- are accessible for service calls,
- accept responsibility for minor adjustments after installation, and
- give a valid estimate of the cost of installation.

After installation, POU/POE systems should have a well-defined program of O&M for continued production of high quality drinking water. The equipment manufacturer's recommended O&M requirements can serve as the basis for the O&M program. Equipment dealers may provide maintenance for a limited time period as part of an installation warranty. A local plumbing contractor, a POU/POE service representative or equipment dealer, a water service company, the local water utility, or a circuit rider may carry out a long-term maintenance program.

Monitoring programs need to be site specific and reflect the contaminant or contaminants being removed, the equipment used, the number of POE/POU units in service, and the logistics of the service area.

Minimum sampling frequencies and types of analyses should be established in cooperation with the local health department, the state regulatory agency, and the treatment system.

Monitoring programs generally include:

- raw and treated water sample collection,
- meter reading,
- field analyses (measuring pH, dissolved oxygen concentration, and other parameters),
- shipment of samples to a laboratory, and
- recordkeeping.

The use of state-approved sampling methods and certified laboratories is a requirement for regulatory compliance.

Remote monitoring and control is becoming a more practical option for small communities and could be part of an O&M agreement developed by a POU/POE vendor. Remotely monitoring operating parameters could provide an attractive alternative to fixed sampling and O&M schedules, thus, allowing customized customer service of the POU/POE device.

A POU/POE vendor could use remote telemetry equipment to review several installations and reduce the number of unnecessary system checks and visits. Remote telemetry also may be used to better schedule routine O&M, troubleshooting problems, and emergency situations.

Selecting an Appropriate POU/POE System

The selection of POU/POE treatment units

should be based on how well a particular type of unit removes specific contaminants from drinking water. Therefore, the selection process involves:

- an evaluation of the quality and type of source water,
- type and extent of contamination,
- treatment requirements, and
- waste disposal requirements.

The treatment requirements are usually compared based on operation and maintenance requirements, cost, and institutional requirements.

For a guarantee that a water treatment unit will perform and remove contaminants that the manufacturer claims, look for certification or registration labels on the treatment units. Two private organizations, the National Sanitation Foundation International (NSF) and the Water Quality Association (WQA), provide product testing. However, manufacturers are not required to test their products under these programs.

NSF International Listing Program

NSF International is a nonprofit, independent testing and research group that provides standards for drinking water treatment components and tests home and personal water treatment devices to determine their ability to improve the aesthetic quality of water and remove health-related contaminants. NSF International has a certification laboratory that can conduct a full range of physical, microbiological, radiological, inorganic, and organic analyses.

NSF uses expert committees to develop its technology standards. The committee includes representation from industry, government, and consumer groups. The committee also receives input from a council of public health consultants and a certification council that has expertise in test methods.

Once an NSF committee develops a standard, the NSF applies to have it certified by the American National Standards Institute (ANSI). An ANSI designation means that only one standard exists for that type of product in the U.S. and that the standard follows all of ANSI's guidelines.

WQA Voluntary Product Validation Program and Voluntary Certification Program WQA, a nonprofit international trade association, awards its Gold Seal to water treatment equipment that passes testing under industry standards for performance, capacity, and durability. WQA does not evaluate claims for removing health-related contaminants. However, WQA has a certification program for POU/POE devices. But remember, WQA is a trade association for POU/POE equipment manufacturers, and although the association provides educational material to the consumer, they also promote the use of treatment equipment.

What about safety and terrorism?

Recent events confirm that bioterrorism is no longer a threat, but a reality. POU filtration systems can reduce many biological warfare agents. POU systems, rated for their ability to remove waterborne biological agents, are available in a range of sizes from individual use to those capable of delivering thousands of liters of water per hour.

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Where can I find more information?

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Z. Michael Lahlou holds a doctorate in environmental and natural resource economics and a master's in civil and environmental engineering. Formerly the technical assistance coordinator for the National Drinking Water Clearinghouse, Lahlou now resides in Huntington Beach, California.

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