

# COST BENEFIT OF POU DEVICES TO PROTECT PUBLIC HEALTH

## Why water treatment in the home?

1. To reduce risk of illness by removing contaminants even further below the Maximum Contaminant Level (MCL) or Action Levels
2. Protection from any unknown or unregulated contaminants existing in the drinking water
3. Protection from unexpected issues in the distribution system post-municipal treatment, such as a water main break or corrosion issue
4. Residential private wells are not treated or monitored by a municipality, it is the responsibility of the homeowner. Several factors make a private well at risk, such as the age of the well, location in proximity to on-site septic systems, and natural events such as flooding
5. Treatment at the point-of-entry at the home can also be used to treat aesthetic concerns, such as taste, odors, and staining issues.

## Microorganisms

There is no amount of harmful microorganisms in water that is considered safe by the US Environmental Protection Agency since consumption of even just one harmful microorganism is capable of causing disease. The risk of illness associated with drinking water varies widely (64% to 0.008%) by factors including the source of water, type of treatment, and types of harmful microorganism present in the drinking water.<sup>1</sup> Risk of illness is greater for infants and children, immunocompromised populations, and the elderly, so the risk of illness from harmful microorganisms will vary throughout a person's life.

## What is a cost-benefit analysis?

Research recently conducted by the University of Arizona found that by using estimated cases of illness caused by harmful microorganisms in drinking water and the associated healthcare and other disease burden costs, the annual cost caused by each pathogen from drinking water can be calculated. When these estimates are compared with the cost of using a POU device to prevent

the illness in the first place and a cost-effectiveness equation (Equation 1), a monetary value per averted case can be calculated for each harmful microorganism and illness case.

This calculation is made with the assumption that a POU device will be used in every household in the United States (325,310,000 population with each household averaging 2.58 individuals, U.S. Census 2010 = 126,089,147 households), and annual reverse osmosis POU treatment cost equal to \$130 (\$318 initial cost and \$83 per year after the first year) per household per year (\$50.22 per person) for a national household intervention cost of \$16.3B, annually.<sup>1</sup>

The burden of drinking water related morbidity and mortality cases, including acute gastrointestinal illness, sequelae, and death, in America is estimated at \$24.2B annually.<sup>1</sup> (See also Table 1)

Results from the cost-effectiveness analysis (Table 8) demonstrate that the highest cost-effectiveness is seen when the totality of disease burden (acute, chronic sequelae, and mortality) from all pathogens is considered. When all of the pathogens and annual disease burden (acute, sequelae, and mortality cases) across the United States are considered, the cost per averted disease case was \$1,252 annually per averted case at a national level.<sup>1</sup> (See also Table 2)

Equation 1: Savings per person from avoided illness by using POU devices at a national level

$$\text{\$USD per averted case} = \frac{\text{Cost}_i - \text{Cost}_n}{\text{Cases}_i - \text{Cases}_n}$$

$$(\$16,338,379,527 - \$24,188,310,427) / (\$3,376,007 - \$9,645,733) = \$1,252$$

Contamination of drinking water with harmful microorganisms can occur without warning and, therefore, without knowledge of the consumer from water main breaks, floods, or corrosion issues. Using a POU device to

to protect against the unknown may be beneficial for peace of mind.

To find water treatment products certified for microbial reduction claims, visit an ANSI-accredited certification body's website, such as the Water Quality Association ([www.wqa.org/Find-Products](http://www.wqa.org/Find-Products)), NSF International ([www.NSF.org](http://www.NSF.org)), IAPMO ([www.iapmo.org](http://www.iapmo.org)), Underwriters Laboratories ([www.ul.com](http://www.ul.com)) or CSA Group ([www.csagroup.org](http://www.csagroup.org)).

**Table 1: Estimated annual number of cases and costs for each drinking water pathogen in the United States (no POU implementation)**

Pathogen	AGI		Sequela		Mortality		TOTAL	
	Annual Case	Annual Cost	Annual Case	Annual Cost	Annual Case	Annual Cost	Annual Case	Annual Cost
<i>Campylobacter sp.</i>	320,000	\$60,800,000	32,640	\$512,807,040	32.6	\$282,576,132	352,673	\$856,183,172
<i>Salmonella sp.</i>	59,000	\$11,210,000	28,645	\$450,033,740	28.6	\$247,985,663	87,674	\$709,229,403
<i>E.coli</i> O517:H7	150,000	\$63,000,000	44,250	\$2,461,052,250	88.5	\$766,176,095	194,339	\$3,290,228,345
Adenovirus	2,700,073	\$513,013,870	21,061	\$330,882,606	0.4	\$3,646,577	2,721,134	\$847,543,053
Rotavirus	3,500,000	\$217,000,000	58,331	\$145,069,197	5.8	\$50,499,229	3,558,337	\$412,568,426
Hepatitis A	32,531	\$6,180,890	4,229	\$83,379,555	12.7	\$109,836,667	36,773	\$199,397,121
<i>Cryptosporidium sp.</i>	1,691,612	\$321,406,280	253,742	\$6,004,038,472	1,268.70	\$10,938,666,742	1,946,623	\$17,309,111,494
<i>Giardia sp.</i>	260,000	\$22,880,000	174,200	\$195,104,000	0.2	\$1,508,112	434,200	\$219,492,112
Norovirus	300,000	\$40,800,000	300	\$7,339,500	0	\$2,597	300,300	\$48,142,097
<i>Legionella</i>	13,000	\$2,470,000	650	\$12,581,111	32.5	\$281,364,103	13,683	\$296,415,214
<b>TOTAL</b>	<b>9,026,216</b>	<b>\$1,258,761,040</b>	<b>618,048</b>	<b>\$10,202,287,471</b>	<b>1,470</b>	<b>\$12,727,261,917</b>	<b>9,645,734</b>	<b>\$24,188,310,428</b>

**Table 2: Total disease and cost burden across the US annually**

Total Disease Burden					
Pathogen	Cost (AGI, Sequelae, Mortality)	Cost of Intervention	Cases_no Intervention (AGI, Sequelae, Mortality)	Cases_POU Intervention	C-E (Total Disease Burden)
ALL	\$24,188,310,427	\$16,338,379,527	9,645,733	3,376,007	\$1,252

**References:**

1. Reynolds, Kelly, Marc Verhougstraete, Akrum Tamimi, and Charles Gerba. (2016) *Cost Benefits of Point-Of-Use Devices in Reduction of Health Risks from Drinking Water*. University of Arizona, Environment, Exposure Science, and Risk Assessment Center.