



The landscaper is a 154-pound adult working on landscapes irrigated with tertiary-treated recycled water every work day. There are 250 work days in a year, assuming a 5-day work week and two weeks of vacation. The worker is exposed to recycled water for an entire 8-hour day and is assumed to be wearing a short sleeve shirt and long pants and that 10 percent of his/her head, forearms and hands are wet with recycled water at any given moment. Incidental ingestion of recycled water occurs at a rate of 4 milliliters each hour. The exposures evaluated include absorption through the skin and incidental ingestion.

This is a high estimation of the amount of water to which a typical landscape worker could be exposed. This is done purposely to build extra margins of safety into the risk assessments in this study (see reverse). This scenario is also representative of workers that come into contact with recycled water in commercial or industrial settings.

**Explaining the Chart:** The chart on the reverse is divided into four columns: column 1 lists ten Pharmaceuticals & Personal Care Products (PPCPs); column 2 explains a little about what these compounds are and how one might come into contact with them in the normal course of daily life; column 3 compares “acceptable”<sup>1</sup> concentrations of these PPCPs to what is actually measured<sup>2</sup> in tertiary- or secondary-treated recycled water. Finally, using actual concentrations of PPCPs found in recycled water, column 4 shows the number of years that it would take, under the above scenario, for the landscaper to be exposed to the equivalent of a dose (or normal daily intake) of the compound from conventional uses.

**Interpreting the Numbers:** Let’s put it all together, using Ibuprofen as our example. Ibuprofen is an over-the-counter (OTC) non-steroidal anti-inflammatory pain reliever (column 2), such as Advil. Acceptable (safe) concentrations of Ibuprofen in recycled water used to irrigate landscapes such as highway or street medians have been calculated to be 530 micrograms per liter (ug/l) (column 3); actual concentrations measured in tertiary- or secondary-treated recycled water systems are typically less than or equal to 1/2 microgram per liter, which is far below levels considered safe. At actual concentrations, the landscape worker could toil, under the above exposure scenario, for 8,600 years before being exposed to the equivalent of one Advil tablet (column 4).

**How much is a microgram?** One microgram per liter is often expressed as one part per billion and is roughly equivalent to one sugar cube in an Olympic size swimming pool.

**Why have only ten PPCPs been listed?** There are currently hundreds of Pharmaceuticals & Personal Care Products (PPCPs) that can be detected in varying concentrations throughout the environment. For the purposes of this study, 10 chemicals were chosen for their associated health risks and/or recognizability. They were carefully selected to be representative of the PPCPs that are present in most recycled water used for irrigation purposes.

For more information, visit:  
[www.athirstyplanet.com](http://www.athirstyplanet.com)

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<sup>1</sup> Acceptable concentrations are calculated concentrations at which adverse health effects are not expected from exposure to recycled water. In other words, levels at which contact with the water is deemed to be safe.

<sup>2</sup> Actual concentrations are the 90th percentile concentrations presented in Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water; Recommendations of a Science Advisory Panel. Final Draft. California State Water Resources Board, June 25, 2010. This means that in a review of available studies in which PPCPs were measured in recycled water, 90 percent of the measured concentrations were equal to or less than the concentrations presented here.

(1) Pharmaceuticals & Personal Care Products - PPCP	(2) How Used/Where Found	(3) Acceptable (safe) vs. Actual Concentrations ug/l	(4) Relative Exposure at Actual Concentrations
<b>Ibuprofen</b> 	Over the counter (OTC) non-steroidal anti-inflammatory pain reliever (NSAID)	Acceptable = 530 Actual = 0.5	Our landscaper could work for 8,600 years before being exposed to the equivalent of one Advil tablet
<b>17-beta estradiol</b> 	Prescription hormone replacement	Acceptable = 0.05 Actual = 0.0084	After 5,000 years the landscaper would be exposed to the equivalent of one dose of this hormone as it is typically prescribed
<b>Fluoxetine</b> 	Prescription antidepressant	Acceptable = 100 Actual = 0.031	After 26,000 years at work the landscaper will have been exposed to the fluoxetine equivalent of one Prozac tablet
<b>Sulfa-methoxazole</b> 	Antibiotic commonly used to treat urinary tract infections or sinusitis	Acceptable = 12,000 Actual = 1.4	After 69,000 years at work, the landscape worker will have been exposed to the equivalent of one prescription dose of this antibiotic
<b>PFOS</b> 	Man-made fluorosurfactant formerly found in Scotchgard, numerous stain repellents, textiles, paper, and leather; in wax, polishes, paints, varnishes, and cleaning products for general use; in metal surfaces, and carpets	Acceptable = 96 Actual = 0.09	The landscaper can work for over a year before he/she reaches the same exposure to PFOS it is estimated he/she receives in one day from other environmental factors
<b>Bisphenol A</b> 	Commonly called BPA; an organic compound known to be estrogenic; used to make polycarbonate plastic (water bottles) and epoxy resins, along with other applications	Acceptable = 620 Actual = 0.29	After 2.2 years at work, the landscaper will be exposed to the equivalent dose of BPA it is estimated he/she ingests from food in just one day
<b>DEET</b> 	N,N-diethyl-meta-toluamide (DEET) is the active ingredient in many insect repellent products	Acceptable = 5,200 Actual = 1.5	After working for nearly 26 million years, the landscaper will be exposed to the equivalent of one application of Deep Woods Sportsman Off to arms, hands and lower legs
<b>Triclosan</b> 	Antibacterial agent found in soap, toothpaste, deodorant; and is infused in an increasing number of consumer products, such as kitchen utensils, toys, bedding, socks, and trash bags	Acceptable = 970 Actual = 0.49	It would take 2,400 years before our landscape worker is exposed to the equivalent amount of Triclosan that he/she would get from washing his/her hands with anti-bacterial soap for 30 seconds
<b>Acetaminophen</b> 	OTC pain reliever	Acceptable = 9,500 Actual = 0.55	It would take 110,000 years of work before the landscape worker is exposed to the equivalent of one Extra-strength Tylenol tablet
<b>Caffeine</b> 	Stimulant found in coffee, tea, chocolate, and other food items	Acceptable = 4,700,000,000 Actual = 0.90	To be exposed to the same amount of caffeine found in a typical cup of coffee, our landscape worker will have to toil for 14,000 years