Recycled Water Exposure Scenario

Ag Worker

The agricultural worker is a 154-pound adult that works in fields that are irrigated 3 days per week for 6 months per year, totaling 78 days of exposure to tertiary-treated recycled water per year. The worker is exposed to recycled water for an entire 8-hour day and it is assumed 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 field worker could be exposed. This is done purposely to build extra margins of safety into the risk assessments in this study (see reverse).

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"[1] concentrations of these PPCPs to what is actually measured[2] 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 worker 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 agricultural land and crops have been calculated to be 1,700 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 agricultural worker could toil, under the above exposure scenario, for 28,000 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

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[1] 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.

[2] 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**
Ibuprofen 	Over the counter (OTC) non-steroidal anti-inflammatory pain reliever (NSAID)	Acceptable = 1,700 Actual = 0.5	Our agricultural worker could work in the fields for 28,000 years before being exposed to the equivalent of one Advil tablet
17-beta estradiol 	Prescription hormone replacement	Acceptable = 0.18 Actual = 0.0084	After 16,000 years the agricultural worker would be exposed to the equivalent of one dose of this hormone as it is typically prescribed
Fluoxetine 	Prescription antidepressant	Acceptable = 320 Actual = 0.031	After 83,000 years in the fields the worker will have been exposed to the fluoxetine equivalent of one Prozac tablet
Sulfa-methoxazole 	Antibiotic commonly used to treat urinary tract infections or sinusitis	Acceptable = 38,000 Actual = 1.4	After 220,000 years at work, the worker will have been exposed to the equivalent of one prescription dose of this antibiotic
PFOS 	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 = 310 Actual = 0.09	The agricultural worker can toil in the fields for five years before he/she reaches the same exposure to PFOS it is estimated he/she receives in one day from other environmental factors
Bisphenol A 	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 = 2,000 Actual = 0.29	After 7.1 years at work, the agricultural worker will be exposed to the equivalent dose of BPA it is estimated he/she ingests from food in just one day
DEET 	N,N-diethyl-meta-toluamide (DEET) is the active ingredient in many insect repellent products	Acceptable = 17,000 Actual = 1.5	After working in the fields for 85 million years, the agricultural worker will be exposed to the equivalent of one application of Deep Woods Sportsman Off to arms, hands and lower legs
Triclosan 	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 = 3,100 Actual = 0.49	It would take 7,600 years before our 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
Acetaminophen 	OTC pain reliever	Acceptable = 30,000 Actual = 0.55	It would take 350,000 years of work before the agricultural worker is exposed to the equivalent of one Extra-strength Tylenol tablet
Caffeine 	Stimulant found in coffee, tea, chocolate, and other food items	Acceptable = 15,000,000,000 Actual = 0.90	To be exposed to the same amount of caffeine found in a typical cup of coffee, our agricultural worker will have to work for 44,000 years