Oregon Drinking Water News
PIPELINE
Department of Human Services, Drinking Water Program

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Revised arsenic standard takes effect in January

by Dave Leland

In 2001, the USEPA revised the Maximum Contaminant Level (MCL) for arsenic from 50 micrograms per liter (ug/L) to 10 micrograms per liter. The revised MCL is effective January 23, 2006, and applies to all community and nontransient, noncommunity water systems.

Water suppliers using surface water sources must sample for arsenic by December 31, 2006. Water suppliers using groundwater sources must sample by December 31, 2007. If a sample taken after January 23, 2006, is above 10 ug/L, then quarterly sampling is required until the results demonstrate that the water is reliably and consistently below the MCL.

Standard monitoring for arsenic is the same as for inorganics; surface water sources must be monitored annually, and groundwater sources every three years. After three rounds of tests with results below 10 ug/L, monitoring can be reduced to once per nine years. Two of these rounds can be from past data provided the correct lab methods and detection limits were used and results were below 10 ug/L.

Dave Leland, PE, is Manager of the Drinking Water Program / (971) 673-0415 or david.e.leland@state.or.us

EPA announces new rules that will further improve and protect drinking water

USEPA

(Washington, D.C.-Dec. 15, 2005). EPA finalized two related drinking water protection rules today — one that reduces the risk of disease-causing microorganisms from entering water supplies and the other that requires water systems to limit the amount of potentially harmful "disinfection byproducts" (DBPs) that end up in our drinking water.

Signed as EPA enters the 31st anniversary year for the Safe Drinking Water Act, the rules were proposed in August 2003 and were developed from consensus recommendations from a federal advisory committee comprised of state and local governments, tribes, environmental, public health and water industry groups.

"Clean drinking water is a key ingredient to keeping people healthy and our economy strong," said EPA Administrator Stephen L. Johnson. "Over the past seven years EPA has worked collaboratively with stakeholders to develop regulations that will provide a balance between the need to disinfect drinking water and protect citizens from potentially harmful contaminants."

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Inside this issue:

Got a drinking water emergency?

by Ron Hall

Just a reminder that the Drinking Water Program provides after-hours and weekend accessibility for drinking water emergencies. **To reach us, contact the Oregon Emergency Response System (OERS) at 1-800-452-0311.** They will contact us and we will contact you.

Be sure to include your local county emergency manager in your emergency communications. Also be sure that the OERS call number is prominently displayed in your water system's emergency response plan and that staff have access to and familiarity with that plan.

During regular business hours, contact us direct at (971) 673-0405 and ask for the drinking water "phone duty person."

Questions? Contact Ron Hall at (971) 673-0409.

Ron Hall, RS, is manager of the Protection, Planning & Certification Unit of the Drinking Water Program / (971) 673-0409 or ronald.a.hall@state.or.us

Monitoring reductions for disinfection byproducts testing

by Diane Stockton

The drinking water program reduced the monitoring schedules for disinfection byproducts (DBPs) for public water systems that use groundwater only, distribute disinfected water and that demonstrate low levels of DBPs in their initial monitoring. The reductions are for total trihalomethanes (TTHM) and haloacetic acids (HAA5) testing, as allowed under the EPA Stage 1 Disinfection Byproducts Rule.

Reduction notifications were mailed to 256 water suppliers and 75 laboratories on December 16, 2005:

- Groundwater systems that serve 10,000 or more people, and which qualify for a reduction, have been reduced to an annual monitoring schedule.
- Groundwater systems that serve fewer than 10,000 people, and which qualify for a reduction, have been reduced to a three-year monitoring cycle (1-1-05 through 12-31-07)

You can review the monitoring schedules for your water system on our Web site, using the "data on-line" feature.

We are now reviewing approximately 300 surface water systems and systems using groundwater under the direct influence of surface water for TTHM, HAA5 and other water quality results for the purposes of adjusting these systems' monitoring schedules. We are on target to complete our review of these systems by the end of the year. We will notify the water suppliers and laboratories of the reductions granted at that time.

Diane Stockton is manager of the Data Management Unit of the Drinking Water Program / (971) 673-0424 or diane.g.stockton@state.or.us

New EPA rules — continued

The rules are important public health measures that will decrease the incidence of gastrointestinal illnesses caused by microbial contaminants and reduce potential cancer risks associated with disinfectant byproducts in drinking water. Finalizing the two rules represents the last phase of a congressionally required rulemaking strategy under the 1996 Amendments to the Safe Drinking Water Act.

The **Long Term 2 Enhanced Surface Water Treatment Rule (LT2)**, increases monitoring and treatment requirements for water systems that are prone to outbreaks of *cryptosporidium*, a waterborne pathogen. Consuming water with *cryptosporidium* causes gastrointestinal illness that can be severe in people with weakened immune systems, such as infants or the elderly and could be fatal in people with severely compromised immune systems, such as those with cancer and AIDS. LT2 will improve public health by reducing illness due to *cryptosporidium* and other harmful microorganisms in drinking water.

The rule requires public water systems that are supplied by surface water sources to monitor their raw untreated water for *cryptosporidium*. Those water systems that measure higher levels of *cryptosporidium* or do not filter their water must provide additional protection by using options from a "microbial toolbox" of treatment and management processes, such as ultraviolet disinfection and watershed control programs.

The rule also addresses risks of contamination in systems that store treated drinking water in open reservoirs, where water quality can be compromised by exposure to outdoor elements. The rule requires open reservoirs to either be covered or receive added treatment.

The **Stage 2 Disinfection Byproducts Rule (Stage 2 DBP)** was developed to balance the benefits and risks posed by drinking water disinfection. While disinfection is commonly known as one of the major public health advances of the 20th century, it also creates harmful byproducts that are formed when disinfectants, such as chlorine, combine with naturally occurring materials in water.

The final rule targets water systems that have the greatest risk of high DBPs by using more stringent methods for determining compliance. Under the rule, water systems are required to find monitoring sites where higher levels of DBPs are likely to occur and use these new locations for compliance monitoring. If DBPs are found to exceed drinking water standards at any of these new monitoring locations, water systems must begin to take corrective action.

The final rules will be published in the *Federal Register* in January. Pre-publication copies and additional information can be found on the EPA Web site at: *http://www.epa.gov/safewater/disinfection/*

News for Release: Thursday, December 15, 2005
U.S. Environmental Protection Agency (EPA)
Contact: Dale Kemery, 202-564-4355 / kemery.dale@epa.gov

Cross Connection/Backflow Prevention Program returns to Drinking Water Program

by Kate Mattimore

New office and contact information

The Cross Connection Program (CCP) office is now back with the Drinking Water Program. Some contact information has changed (see below) but the program coordinator remains the same. The CCP benefits by integrating with resources and the expertise within the Drinking Water Program for such functions as sanitary surveys that include cross connection program requirements, database sharing for water system records and reports, and support staff.

House Bill 3108 establishes funding for the Cross Connection Program

The Cross Connection Program has been funded in the past by General Funds. Having dedicated fees will provide the stability the program has long

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Cross Connection/Backflow Prevention — continued

needed to serve the industry. House Bill 3108 was passed by the Legislature effective September 2005. It provides for annual fees to support the Cross Connection Program. The fee is based on the total number of service connections in each community public water system as follows:

15 – 99 connections	$30
100 – 999 connections	$75
1,000 – 9,999 connections	$200
10,000 or more connections	$350

Billing invoices for these fees will be mailed along with the Annual Summary Report to all community public water systems with 15 or more service connections in the first quarter of 2006.

An effective Cross Connection Program is one of many important elements needed for protection of a public water supply. The Cross Connection Program supports your water system's efforts towards cross connection control and the prevention of backflow. The program coordinator can assist you with your questions or requests for information about cross connection or backflow related topics and department requirements. The program also provides several lists in various formats to water suppliers such as current department-certified Backflow Assembly Testers or Cross Connection Specialists by county, alphabetical names or certification numbers, and a list of approved backflow prevention assemblies for use in Oregon. The program maintains a Web site (shown below) with general program information, various downloadable forms and a list of contacts and resources.

Certification

All Backflow Assembly Tester and Cross Connection Specialist certifications expired June 30, 2005. Approximately 1,200 individuals applied for renewal and are currently certified with the Department for the next 2-year certification period. The expiration date at the bottom of your current certification should indicate June 30, 2007. If the date shows June 30, 2005 you are not currently certified. Backflow assembly tests submitted by an uncertified Backflow Assembly Tester are not valid and must be retested by a certified tester. Please contact the program coordinator if you wish to renew. A late fee of $50 will be added to any applicant renewing 30 days after expiration. Additional requirements apply after June 30, 2006.

Cross Connection Advisory Board

Oregon Administrative Rules require the Cross Connection Program to establish a Cross Connection Advisory Board. The initial meeting was held in Portland on May 27, 2005. Accomplishments include approval of advisory board meeting guidelines, by laws and a list of priority issues to address. Meetings are open to the public and the program encourages your involvement. One public member position remains vacant. If you have any suggestions for a possible candidate, please contact the program coordinator.

The next advisory board meeting will be:
February 3, 2006
800 NE Oregon Street, Suite 918
1:30 PM to 3:30 PM.

Current advisory board members are:

Name	Representing
Mary Howell, Chair	Cross Connection Specialists
Steven West, Vice-Chair	Instructors
Ronald Robertson	Plumbers
Pat Dorning	Water Suppliers
Jerry Thomas	Manufacturers
Monica Anderson, PE	Engineers
James Clark	Backflow Assembly Testers
Joe McNelly	Plumbing Inspectors

Annual Summary Report

The time is near for preparation and submission of the Annual Summary Report as required by Oregon Administrative Rules 333-061-0070(9)(c). All community public water systems shall prepare and submit this report before the end of March each year to document their water system's annual efforts towards cross connection control and testing summaries. The 2005 forms and instructions are available on the program Web site as listed below or by contacting the program coordinator.

Kate Mattimore is program coordinator for the Backflow Program in the Drinking Water Program: (971) 673-1220, Fax: (971) 673-0457, Email: Kathryn.j.mattimore@state.or.us. Web site: http://www.healthoregon.org/crossconnection
Mail: DHS DWP Cross Connection Program (CC/BPP) PO Box 14450, Portland OR 97293-0450

Dennis Nelson receives the Groundwater Foundation's E. Benjamin Nelson Government Service Award

Dennis Nelson, groundwater coordinator for the State of Oregon Department of Human Services Drinking Water Program, received the Groundwater Foundation's 2005 E. Benjamin Nelson Government Service Award. The foundation established the Government Service Award in 1998 to recognize government officials who have significantly advanced environmental and groundwater stewardship. The award was named after two-term Nebraska Governor Ben Nelson in honor of his service to groundwater.

As a groundwater coordinator, Dennis has overseen the development of drinking water protection plans for communities throughout the state. He also made significant contributions to the development of Oregon's Drinking Water Protection Plan and Source Water Protection Plan. In addition, he conducts or oversees the scientific modeling and geological studies used to evaluate risks to aquifers. Dennis helps resolve groundwater issues; generates original field data at investigation sites; organizes and presents hydro-geologic data; and identifies alternative solutions under Oregon's Drinking Water Program. He is also responsible for determining the impact of contamination sources, evaluating alternative solutions, and presenting them to affected water suppliers and the general public.

Dennis serves as advisor to the Drinking Water Program on issues related to groundwater policies and works closely with state agencies to help coordinate state programs. These include local land use planning, regional water planning, underground storage tank rules, water resource management, well construction requirements, and cleanup/ investigation of groundwater contamination in areas near public water supplies.

Dennis conducts training sessions for water operators, city officials, community outreach, children's education and well drillers. He has taught courses on Groundwater, Drinking Water Protection, and Source Water Assessments at various organizational meetings, community colleges, and schools. He organized a workshop on Groundwater Protection and Land Use Planning at the 2002 Groundwater Foundation Annual Conference. Dennis has also taught courses in physical geology, chemical hydrogeology and environmental assessments at Portland State University, and the University of Oregon.

Dr. Dennis Nelson receiving the award from Senator Ben Nelson

Dennis served as co-chair of the Oregon Academy of Sciences — Geology Section and as associate editor and author for a water science encyclopedia published by MacMillan. He has written a groundwater training manual and his article on the use of well reports in hydrogeologic studies was accepted by the National Ground Water Association for publication in the 2003 *Water Well Journal*. Dennis was a principal author of a report on *Alternative Strategies for Minimizing the Impact of Business Activities in Wellhead Protection Areas*. Dennis has served with national workgroups for groundwater issues including the EPA's Groundwater Rule.

The Government Service Award was presented to Dennis on November 4, 2005, at an awards luncheon in conjunction with The Groundwater Foundation's Annual Conference November 2-4, at the Lied Conference Center in Nebraska City, Nebraska. The Groundwater Foundation gratefully acknowledges CH2M Hill and Central Nebraska

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Consumer pollution: Pharmaceuticals and personal care products

by Dennis Nelson

When most of us think about pollution, we generally think of factories, fuel depots and other commercial activities of one sort or the other. A newly recognized class of chemicals, pharmaceutical and personal care products (PPCPs), are being recognized in surface water and groundwater worldwide.

The source of these chemicals is not big industry or big business, but rather, their presence reflects the largely unintentional activities of individual consumers. The relative risk that these chemicals pose to the environment and human health is unclear at this point. Although individually at trace quantities, the additive or synergistic effects of the near continuous exposure to these chemicals may result in significant long-term impacts. This article summarizes information regarding the origin, occurrence and treatment of PPCPs provided by a 2005 AWWA Webcast along with several of the many articles that exist concerning these chemicals.

What are PPCPs?

Pharmaceuticals and Personal Care Products (PPCPs) consist of thousands of diverse chemical compounds, such as prescription drugs, (including antibiotics, steroids and synthetic hormones), as well as over-the-counter therapeutic drugs, herbal remedies, cosmetics, fragrances, shampoos, sun screen additives, veterinary drugs, feed additives and many, many others. PPCPs include any product that people use for personal health or cosmetic reasons (Daughton, 2003). The intended targets for these compounds include not only people, but pets and livestock as well.

What is the occurrence of PPCPs?

A recent AWWA Webcast program (AWWA Webcast, 2005) reported the occurrence of 158 PPCP compounds in water. The list included 45 antibiotics, 12 prescription drugs, 8 nonprescription drugs, 14 hormones and steroids, and 79 household and industrial compounds. Many more of these chemicals exist than were actually looked for, implying that others may be detected in the future as analytical methods become available. National reconnaissance studies of streams, groundwater and sources of drinking water in the period 1999-2000 yielded the results listed in Table 1. Every site sampled contained at least some PPCP chemicals.

The concentrations of PPCPs detected thus far are in trace quantities, ranging from 100s of ppb (ug/L) to sub-ppt (ng/L).

What is the source of PPCPs?

The primary origin of PPCPs in the environment is the worldwide, continual usage by humans and domestic animals. These pollutants occur as a result of ingestion/excretion to municipal sewers and septic systems as well as the intentional disposal of expired or unwanted PPCPs to sewage or landfills. Other potential sources include leaching from municipal landfills or from applied municipal

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Table 1	Surface water 139 samples	Groundwater 47 samples	Sources of drinking water 74 samples
Non-drugs	81%	15%	64%
Antibiotics	48%	26%	26%
Pharmaceuticals	32%	6%	23%
Metabolites	69%	43%	19%
DEET	74%	35%	19%
Caffeine	71%	11%	54%

Table 1. *Summary of PPCP occurrences, as percentage of samples collected, in streams, groundwater and drinking water sources based on a national reconnaissance study in 1999-2000 (Koplan, 2005). DEET is an insect repellent.*

PPCPs — continued

biosolids, runoff from confined animal feeding operations, medicated pet excreta and direct discharge of raw sewage. Also as a category is the disposal of illicit drugs either by the ingestion/excretion pathway or by releases associated with illegal drug labs. A summary of pathways of PPCPs in the environment is provided in the diagram: Origins and Fate of PPCPs in the Environment (see *http://epa.gov/nerlesd1/chemistry/pharma/images/drawing.pdf*).

Much discussion has recently been centered on the proper disposal of outdated or unwanted prescription drugs. Rightly so, individuals have wanted to safeguard family members, especially children and the elderly, from unintentional exposure to medications not intended for them. Past practices have included disposal of drugs by flushing them down the toilet. A recent survey indicates approximately 35 percent of consumers still use this practice (Boehringer, 2004). While this does ensure that family members or pets will not accidentally ingest these medications, it does provide a direct pathway to the environment.

Many Oregon pharmacies will accept these medicines for proper disposal, e.g., incineration, as will some local waste management facilities. Although not a preferred method, getting rid of drugs through trash pickup and landfill disposal is a better alternative than releasing them to the environment via sewage disposal.

Personal care products such as shampoo, cosmetics, etc. differ from pharmaceuticals in three major aspects: (1) the design of the packaging discourages disposal of the contents via the sewage, (2) the ingredients are not designed to interact biologically to influence cellular functions, and (3) personal care products are used primarily external to the body (EPA NERL). These products are generally used in higher concentrations, however, and organisms in the aquatic environment may be exposed to sustained and substantial concentrations. Certain of these compounds can be absorbed through the skin, e.g., phthalates (plastics), UV screens and fragrances.

What are the concerns associated with PPCPs?

Most medicines tend to resist break-down by bacteria and will therefore find their way to surface and groundwater. Because of the trace concentrations of these chemicals, it would take a significant period of time, consuming approximately a gallon of water a day, to achieve a single therapeutic dose of most of these chemicals: consuming the equivalent of one tablet of Valium or Ritalin would take 3.5 years; a capsule of Benadryl 14.5 years; and one tablet of Childrens Tylenol 58 years (Seiler, 2003). While these concentrations are very low, they are entering the aquatic environment on a continuous basis. This leads to a situation that exposure to these chemicals, particularly for aquatic life, is constant and may accumulate over many generations. The rapid development of new PPCPs and the growing tendency of drug prescription in the United States will, of course, result in an increase in the environmental occurrence of PPCPs.

An additional area of concern exists with respect to PPCPs. Although individual concentrations are low, the long-term affect of the near continuous presence of multiple chemicals at the same time may prove problematic. What are the additive effects of minute individual quantities of many chemicals of the same class? Are there synergistic effects, where the combined presence of more than one chemical leads to an enhanced effect greater than the sum of the chemicals individually? We know that the concentrations are unlikely to produce an acute response to exposure, however the long-term effects are as yet largely unknown. Because of the lack of health effects data, regulation of PPCPs through the Safe Drinking Water Act is unlikely in the near future, although a screening and testing program for endocrine disrupters is provided for in the 1996 Food Quality Protection Act (Roberson, 2005)

Two aspects of PPCPs in the environment have received the bulk of the attention so far: hormone disruption in fish by natural and pharmaceutical estrogens, and the mis(over)use of antibiotics, leading to the evolution of resistant pathogens in the environment.

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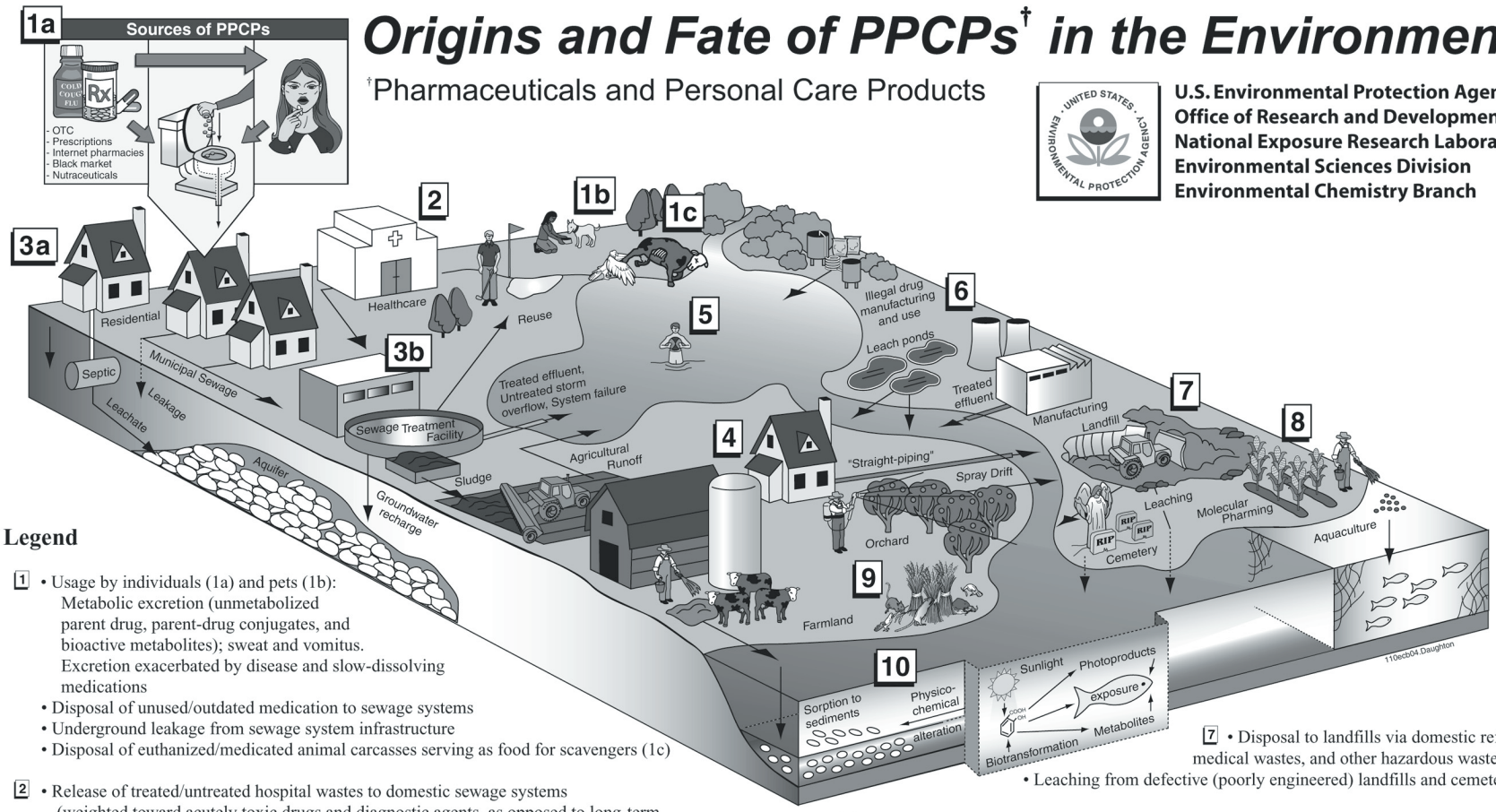
Origins and Fate of PPCPs† in the Environment

†Pharmaceuticals and Personal Care Products

U.S. Environmental Protection Agency
Office of Research and Development
National Exposure Research Laboratory
Environmental Sciences Division
Environmental Chemistry Branch



Legend

1 • Usage by individuals (1a) and pets (1b):
Metabolic excretion (unmetabolized parent drug, parent-drug conjugates, and bioactive metabolites); sweat and vomitus.
Excretion exacerbated by disease and slow-dissolving medications
• Disposal of unused/outdated medication to sewage systems
• Underground leakage from sewage system infrastructure
• Disposal of euthanized/medicated animal carcasses serving as food for scavengers (1c)

2 • Release of treated/untreated hospital wastes to domestic sewage systems (weighted toward acutely toxic drugs and diagnostic agents, as opposed to long-term medications); also disposal by pharmacies, physicians, humanitarian drug surplus

3 • Release to private septic/leach fields
• Treated effluent from domestic sewage treatment plants discharged to surface waters or re-injected into aquifers (recharge)
• Overflow of untreated sewage from storm events and system failures directly to surface waters

4 • Transfer of sewage solids ("biosolids") to land (e.g., soil amendment/fertilization)
• "Straight-piping" from homes (untreated sewage discharged directly to surface waters)
• Release from agriculture: spray drift from tree crops (e.g., antibiotics)
• Dung from medicated domestic animals (e.g., feed) - CAFOs (confined animal feeding operations)

5 • Direct release to open waters via washing/bathing/swimming

6 • Discharge of regulated/controlled industrial manufacturing waste streams
• Disposal/release from clandestine drug labs and illicit drug usage

7 • Disposal to landfills via domestic refuse, medical wastes, and other hazardous wastes
• Leaching from defective (poorly engineered) landfills and cemeteries

8 • Release to open waters from aquaculture (medicated feed and resulting excreta)
• Future potential for release from molecular pharming (production of therapeutics in crops)

9 • Release of drugs that serve double duty as pest control agents:
examples: 4-aminopyridine, experimental multiple sclerosis drug → used as avicide; warfarin, anticoagulant → rat poison; azacholesterol, antilipidemics → avian/rodent reproductive inhibitors; certain antibiotics → used for orchard pathogens; acetaminophen, analgesic → brown tree snake control; caffeine, stimulant → *coqui* frog control

10 Ultimate environmental transport/fate:
• most PPCPs eventually transported from terrestrial domain to aqueous domain
• phototransformation (both direct and indirect reactions via UV light)
• physicochemical alteration, degradation, and ultimate mineralization
• volatilization (mainly certain anesthetics, fragrances)
• some uptake by plants
• respirable particulates containing sorbed drugs (e.g., medicated-feed dusts)

Christian G. Daughton, U.S. EPA-Las Vegas

January 2004
(original February 2001)

http://epa.gov/nerlesd1/chemistry/pharma/images/drawing.pdf
from: http://epa.gov/nerlesd1/chemistry/pharma/

PCPPs — continued from page 7

The issue of hormone disruption involves steroidal chemicals such as the sex steroids, including oral contraceptives, that have the effect of interfering with the endocrine system of organisms. As defined by the USEPA, the endocrine system consists of glands and hormones that control or regulate many biological processes within the body. Some of the effects of these agents include the feminization of male fish and the alteration of the behaviors of either sex at the part-per-trillion concentration level (Daughton, 2003). Effects include adverse impacts on reproduction, development, neurological behavior and carcinogenicity (AWWA Webcast Program, 2005).

With respect to pathogen resistance, the World Health Organization warns that increasing drug resistance could significantly reduce our ability to cure illnesses and stop epidemics. Curable diseases, varying from sore throats to TB and malaria, may become incurable as our once-effective medicines become increasingly ineffective (See report at *http://www.who.int/multimedia/antibiotic_res/index.html*).

Treatment for PPCPs.

It is understood that the conventional treatment of surface water, i.e., coagulation/flocculation, is not effective at removing most of the PPCP chemicals (Snyder, 2005). The reason for this is that most PPCPs will not bind during the flocculation process. Other processes such as chlorination, activated carbon, reverse osmosis, etc. are effective for some, but not all, PPCPs. Snyder (2005) states that the least effective treatment method is ultraviolet light while the most effective is reverse osmosis. He provides a relative ranking of treatment removal of PPCPs as follows: reverse osmosis > advanced oxidation > granular activated carbon > ozone > chlorine > chloramines > ultraviolet light. Table 2. on page 10 provides a list of PPCPs in raw versus finished drinking water from 18 utilities using various treatment processes across the United States.

Summary

- A wide range of pharmaceuticals and personal care products (PPCPs) have been detected in surface and groundwater worldwide.
- The PPCPs include antibiotics, hormones, prescription drugs, over-the-counter drugs, household chemicals, feed supplements and veterinary medications.
- Concentrations of these compounds are in the microgram to nannogram range.
- The primary source of these chemicals is waste from individual consumers through wastewater treatment plants and septic systems.
- Conventional treatment of surface water is not an effective mechanism for the removal of PPCPs.
- With respect to the ability other treatment methods to remove PPCPs: RO > AOP > GAC > Ozone > Chlorine > UV.
- Impacts by hormones and steroids on aquatic organisms, e.g., fish, have been recorded as has the development of resistant pathogens as a result of antibiotics in water.
- Regulation of PPCPs through the Safe Drinking Water Act in the near future is not likely because of the largely unknown long-term health effects.

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Seiler, R.L., 2003. Chemicals from Consumers. In Dasch, E.J. (ed.) Water Science and Issues. Macmillan Reference USA, The Gale Group, pp. 155-158.

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Useful Web sites:

http://www.awwa.org/Advocacy/YourWater/Issues/OnPoint_PPCPs.cfm

http://epa.gov/nerlesd1/chemistry/pharma/index.htm

http://www.who.int/multimedia/antibiotic_res/index.html

Dennis Nelson is a Geologist in the Drinking Water Program / (541) 726-2587 ext. 21

Chemical (Use)	Raw water (ng/L)	Percent of samples detected in	Finished water (ng/L)	Percent of samples detected in
DEET (1)	10.8	100	10.9	94.4
TCEP (2)	21.9	94.4	9.9	88.9
Caffeine (3)	26.6	94.4	27.7	83.3
Ibuprofen (4)	7.3	83.3	10.4	77.8
Atrazine (5)	153.8	77.8	117.8	72.2
Meprobromate (6)	6.8	66.7	5.7	66.7
Dilantin (7)	4.1	88.9	3.3	61.1
Iopromide (8)	13.8	61.1	9.0	55.6
Carbamazapine (7)	5.7	88.9	4.1	44.4
Gemfibrozil (9)	6.1	61.1	5.2	22.2
Estrone (10)	1.4	5.6	1.2	11.1
Acetaminophen (4)	3.6	22.2	1.1	5.6
Ethromycin-H20 (11)	2.7	44.4	2.6	5.6
Sulfamethoxazole (11)	17.8	83.3	2.1	5.6
Naproxen (12)	5.6	61.1	1.0	5.6

(1) insect repellent; (2) flame retardant; (3) coffee; (4) analgesic; (5) pesticide; (6) tranquilizer; (7) antiepileptic drug; (8) radiographic contrast agent; (9) cholesterol medication; (10) hormone; (11) antibiotic; (12) pain reliever, anti-inflammatory

Table 2. Comparison of concentrations (in ng/L = 0.000001 mg/L) of PPCPs in raw water and finished water. Concentrations represent averages of 18 different utilities located across the United States, using various treatment methods (Snyder, 2005).

Nelson receives award — continued from page 5

Public Power and Irrigation District as the co-sponsors of the 2005 National Awards program and the Nebraska Environmental Trust for their support for the awards luncheon.

For further information on the E. Benjamin Nelson Government Service Award, or to receive an Awards Nomination booklet, please contact the Groundwater Foundation at 800-858-4844 or visit the Foundation's Web site at www.groundwater.org.

Training calendar

CEUs for Water System Operators

Check *www.oesac.com* for new offerings approved for drinking water.

Twenty-Second Annual Waterworks & Waste Water Short School

March 12-15 — Valley River Inn, Eugene
Register online at: *www.awwa-shortschool.com*

Stage 2 Disinfection Byproducts & LT2 Rules
For water systems serving 50,000 or more people
March 22-23
To register, contact Wendy Marshall at marshall.wendy@epa.gov

Cross Connection/Backflow Courses

Backflow Management Inc. (B)
(503) 255-1619

Clackamas Community College (C)
(503) 657-6958 ext. 2388

Backflow Assembly Tester Course

Feb. 27-Mar. 3	Portland (B)
Mar. 13-17	Oregon City (C)
Apr. 17-21	Portland (B)
June 26-30	Portland (B)

Backflow Assembly Tester Recertification

Mar. 3	Oregon City (C)

Cross Connection Inspector Course

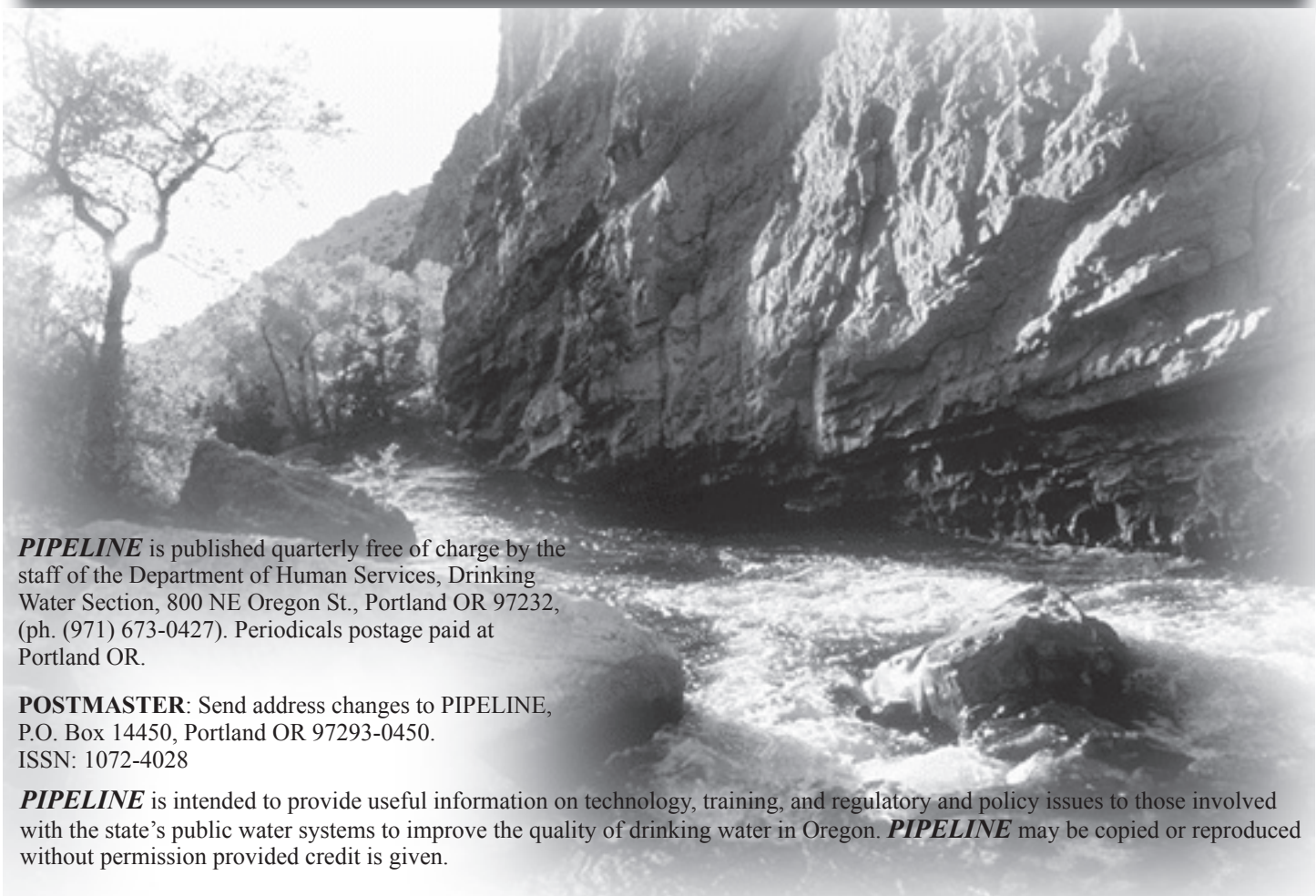
Apr. 10-13	Portland (B)
June 12-15	Portland (B)

Water System Training Course
Department of Human Services
Marsha Fox /(971) 673-0408

Mar. 1	Jackson & Josephine Counties
April *	Clackamas, Washington, Multnomah & Marion Counties
June *	Wasco, Sherman, Hood River, Gilliam, Coos & Curry Counties

* Dates and locations to be announced

Department of Human Services
Drinking Water Program
PO Box 14450
Portland, OR 97293-0450



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