

# Pharmaceuticals and Personal Care Products (PPCPs) as Pollutants



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# Pharmaceuticals and Personal Care Products as Pollutants



PPCPs refers to:

- Products used by individuals for personal health or cosmetic reasons
- Products used by agribusiness to enhance growth or health of livestock.



# Pharmaceuticals and Personal Care Products as Pollutants

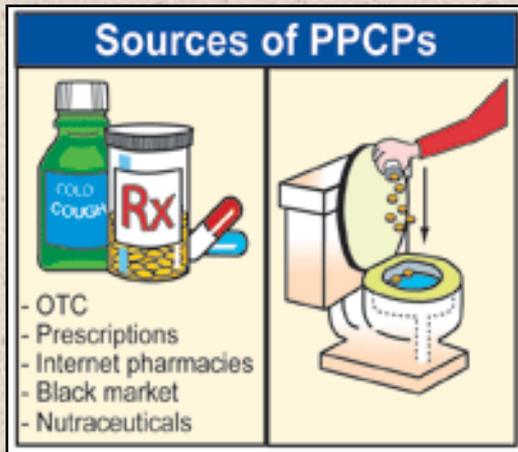


PPCPs comprise a diverse collection of thousands of chemical substances including:

- Prescription and over-the counter therapeutic drugs
- Veterinary drugs
- Fragrances
- Cosmetics
- Sun-screen products
- Diagnostic agents
- Nutraceuticals (e.g., vitamins)



# PPCPs Enter The Environment Through Use and Disposal

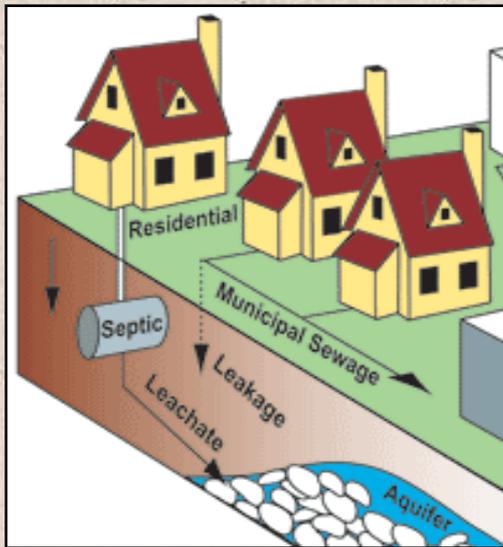


PPCPs have probably been present in the environment for as long as humans have been using them. Individuals add PPCPs to the environment through:

- Excretion
- Bathing
- Disposal of unwanted medications to sewers and trash.
- Unused/unwanted quantities as much as 50% of many prescriptions - 80% for antibiotics
- Common/historical recommendation was to flush; "crush & flush" is still widely practiced method



# Pharmaceuticals and Personal Care Products as Pollutants



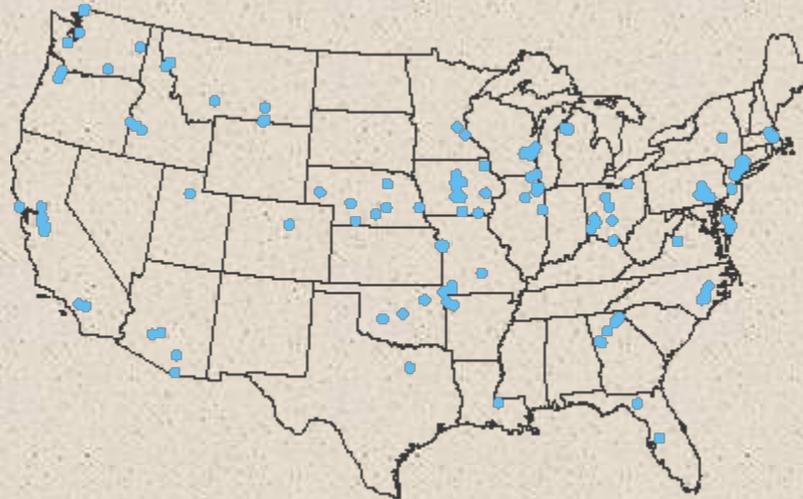
- The drugs that we take may be excreted in a biologically active form into wastewater and ultimately released into lakes and rivers.
- Advances in technology have improved our ability to detect and quantify these chemicals.
- Their effect on the environment is now recognized as an important area of research.



# PPCPs Are Present in Our Nation's Waterbodies

## National Stream Reconnaissance: U.S. Geological Survey (USGS), 1999-2000

- This study was the first national-scale examination of emerging contaminants in streams of the United States.
- Water samples were collected from a network of 139 streams across 30 states during 1999 and 2000.
- The sampling sites focused towards streams considered to be susceptible to contamination. Thus, the results of this study are **not** considered representative of all streams.



# PPCPs Are Present in Our Nation's Waterbodies

## RESULTS:

- One or more chemicals were detected in 80 percent of the streams sampled, and 82 of the 95 chemicals were detected at least once.
- Generally, these chemicals were found at very low concentrations (in most cases, less than 1 part per billion).
- Mixtures of the chemicals were common:
  - 75 percent of the streams had more than one
  - 50 percent had 7 or more
  - 34 percent had 10 or more.



# PPCPs Are Present in Our Nation's Waterbodies

## RESULTS:

- The most frequently detected chemicals (found in more than half of the streams) were:
  - Coprostanol (fecal steroid)
  - Cholesterol (plant and animal steroid)
  - N-N-diethyltoluamide (insect repellent)
  - Caffeine (stimulant)
  - Triclosan (antimicrobial disinfectant)
  - Tri (2-chloroethyl) phosphate (fire retardant)
  - 4-nonylphenol (nonionic detergent metabolite).
- Steroids, nonprescription drugs, and insect repellent were the chemical groups most frequently detected.
- Detergent metabolites, steroids, and plasticizers generally were measured at the highest concentrations.



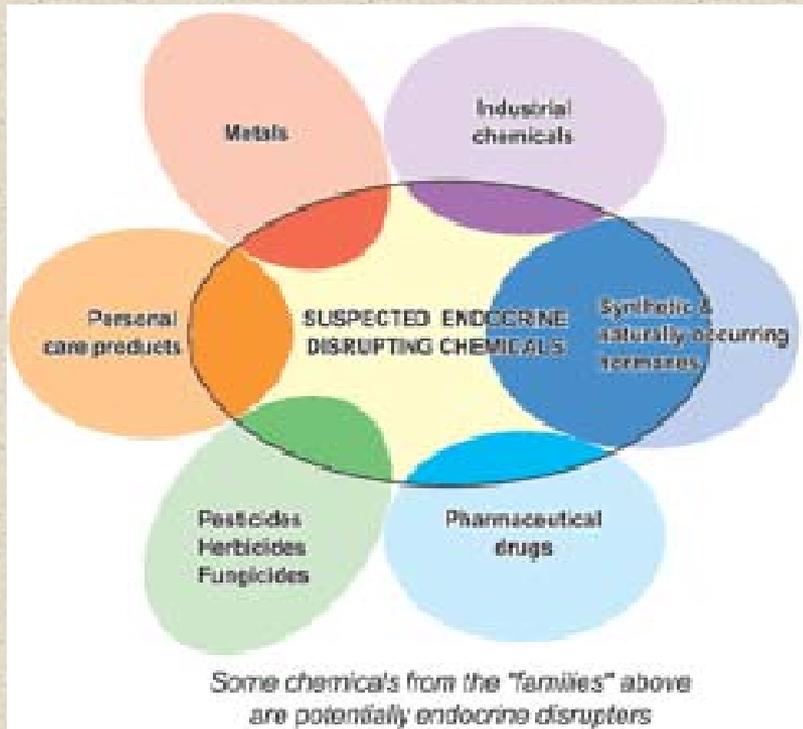
# PPCPs Are Present in Our Nation's Waterbodies

## **Human and environmental effects:**

- Knowledge of the potential human and environmental health effects of these 95 chemicals is highly varied.
- Drinking-water standards or other human or ecological health criteria have been established for 14.
- Measured concentrations rarely exceeded any of the standards or criteria.
- Thirty-three are known or suspected to be hormonally active.
- 46 are pharmaceutically active.
- Little is known about the potential health effects to humans or aquatic organisms exposed to the low levels of most of these chemicals or the mixtures commonly found in this study.



# Some Pharmaceuticals are Endocrine Disrupting Chemicals



A group of chemicals, known as endocrine disruptor chemicals (EDCs), has been identified as having the potential to cause adverse health effects in humans and wildlife.

Among this group DDT, PCBs, endosulfan, methoxychlor, diethylphthalate, diethylhexylphthalate, and bisphenol A may occur in drinking water.



# PPCPs May Cause Ecological Harm

## Further research:

- Antibiotics, hormones, SSRIs are receiving the most attention.
- Boulder Creek, CO, study: 50:50 female:male ratio upstream, 90:10 downstream; ethynylestradiol measurably higher downstream.
- Male fish are producing eggs in the Potomac River. Bioassays of SSRIs are showing some sub-lethal effects at environmentally relevant levels.
- 2006 Italian study found that a mixture of common drugs at very low (ng/L-environmentally-relevant) concentrations inhibited the growth of human embryonic cells



# More Issues To Consider

## Too Many Pharmaceuticals Go Unused

- PhRMA uses an estimate of 3% of all meds go unused
  - Recent British survey showed:
    - 82% of antibiotics go unused
    - 50% of antidepressants
    - 50% of beta-blockers
    - 20% of pain meds
- Compliance/adherence rates for some medications are under 20%
- Patient compliance goes down as # of medications goes up: “polypharmacy”
- Medicare Part D now requires 30-day supply billings, regardless of need and without ability to refund unused expenses (or to return unused product)



# More Issues To Consider

## Too Many Pharmaceuticals Go Unused

- “Rampant non-compliance” and poor adherence to medication regimens, coupled with medication errors, present a significant health care issue, especially for the elderly
- Accumulations of unused meds have become a national burden, both in health care cost and in potential for diversion and abuse
- Hospice nurses, nursing homes and medical examiners are faced with large accumulations of medicines, including potent controlled substances, when patients die
- “Catch 22” for handling the leftovers – no easy, safe, legal or environmentally acceptable answers

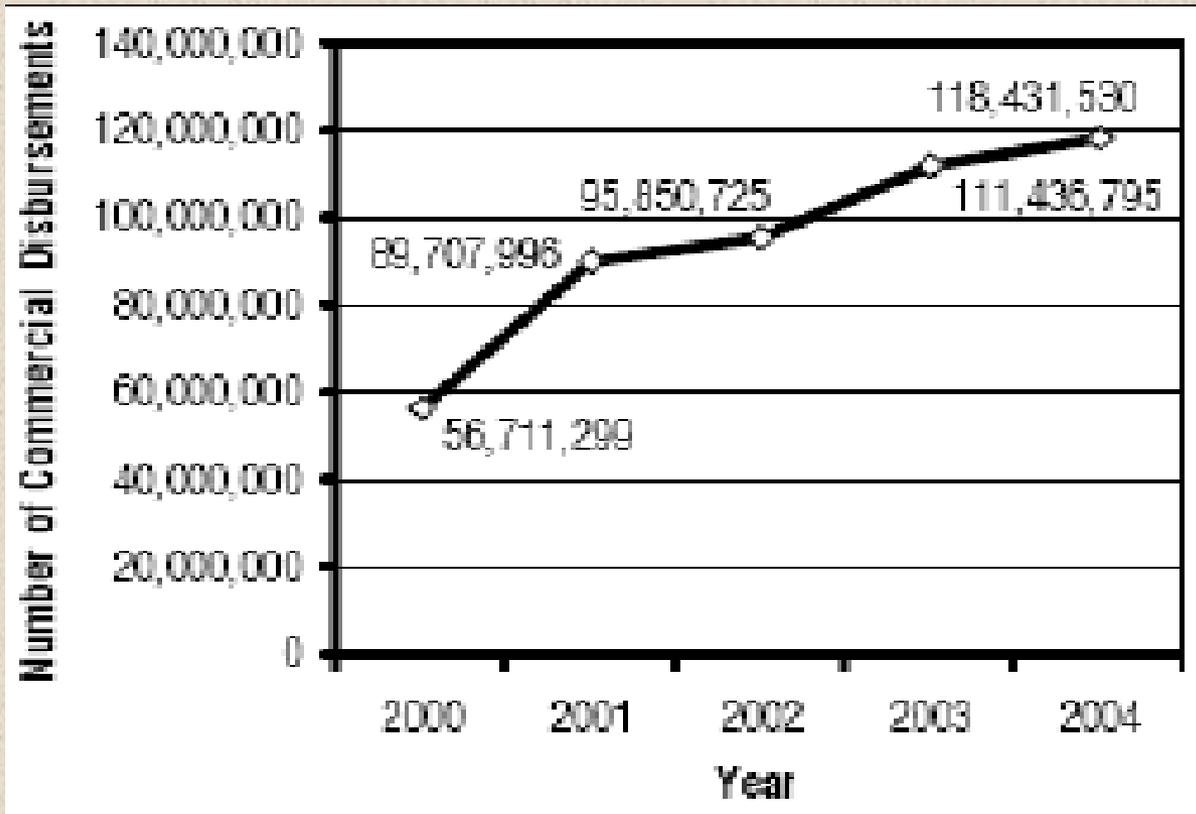


# More Issues To Consider

## Drug Sales Have Skyrocketed

U.S. sales have more than doubled in last 5 yrs

(Ref: National Drug Intelligence Center, 2005, via Ilene Ruhoy, 2006)



# More Issues To Consider

## Drug Sales Have Skyrocketed

- Between 1992 and 2002:
  - U.S. population grew 13%
  - # non-controlled prescriptions increased 57%
  - # controlled drug prescriptions increased 154%(ref: CASA, via Irene Ruhoy, 2006)
- This increased use and availability is one key to the current concerns over what to do with the left-overs.



# More Issues To Consider

## Poisonings

- Unintentional injuries were 5th leading cause of death overall in the U.S. and the leading cause for those under age 45. (Does not include suicides or homicides)
- Of all unintentional injuries that resulted in death, poisonings accounted for 16.4%
- Of all poisonings, 93.4% were drug-related



# More Issues To Consider

## Poisonings

Of all calls to U.S. poison control centers in 2004:

- 2,438,644 total exposures reported
- 1,389,156 (57%) were pharmaceutical exposures
- 581,488 (42%) of the pharm exposures were to children under 6 years of age



# More Issues To Consider

## Pharms at Home Increase Drug Abuse

Between 1992 and 2003:

- U.S. population grew 14%
- # of teens (12 to 17 yrs of age) who abused controlled prescription drugs jumped 212%
- # of adults (18 and older) abusing such drugs climbed 81%
- # of all Americans who abuse controlled prescription drugs nearly doubled, from 7.8 million to 15.1 million



# More Issues To Consider

## Pharms at Home Increase Drug Abuse

- The # (15.1 million) of controlled prescription drug abusers exceeds the combined # of Schedule I (illegal) drug abusers:
  - Cocaine = 5.9 million
  - Hallucinogens = 4.0 million
  - Inhalants = 2.1 million
  - Heroin = 0.3 million



# More Issues To Consider

## Pharms at Home Increase Drug Abuse

- “Pharming” is latest craze among teens  
*‘Generation Rx’*
- One in five teens says he or she has been offered prescription drugs to get high
- In 2003, 15% of all American teens abused or were addicted to controlled drugs



# Summary of the Problem

- Lots of unused drugs in people's homes
- Poisoning and abuse concerns
- Low compliance = high accumulations
- Leftovers are routinely flushed
- Pharms are showing up in the environment
- No safe, legal, environmentally-acceptable options





# Resource Conservation and Recovery Act (RCRA)

- The [Resource Conservation and Recovery Act \(RCRA\)](#) is a federal law controlling the management and disposal of solid and hazardous wastes produced by a wide variety of industries and sources.
- The RCRA program regulates the management and disposal of hazardous pharmaceutical wastes produced by pharmaceutical manufacturers and the health care industry.
- Under RCRA, a waste is a hazardous waste if it is specifically listed by the EPA or if it exhibits one or more of the following four characteristics: ignitability, corrosivity, reactivity and toxicity.
- RCRA does not regulate any household waste, which includes medications/pharmaceutical waste generated in a household.





# CONTROLLED SUBSTANCE ACT

<http://www.deadiversion.usdoj.gov/schedules/schedules.htm>

- Schedule I – illegal drugs (ex., heroin, LSD)
- Schedule II – morphine, OxyContin, codeine, Demerol, Ritalin, amphetamines
- Schedule III – Tylenol with codeine, Vicodin
- Schedule IV – benzodiazepines, Valium, Darvon
- Schedule V – codeine cough syrups



# PROPER DISPOSAL OF PHARMACEUTICALS WORK GROUP

- Salt Lake City Public Utilities:** Florence Reynolds  
Water Quality and Treatment Administrator
- Salt Lake City Police Department:** Jim Hill, Manager Police - Crime Lab  
Ruthanne Ogletree, Evidence
- Board of Pharmacy:** Roger B. Fitzpatrick, Chairperson
- Salt Lake Valley Health Department:** Dorothy Adams, Manager  
Household Hazardous Waste Disposal
- Utah Department of Health:** Iona M. Thraen, Patient Safety Director  
Health Systems Improvement
- Utah Poison Control Center /University of Utah College of Pharmacy**  
Barbara Insley Crouch, PharmD, MSPH  
Director, Utah Poison Control Center
- Utah Department of Environmental Quality:** Leah Ann Lamb, Director  
Office of Planning and Public Affairs



# PROPER DISPOSAL OF PHARMACEUTICALS WORK GROUP

## Web Site

Proper Medication Disposal:

- [http://www.deq.utah.gov/Issues/Medication\\_Disposal/index.htm](http://www.deq.utah.gov/Issues/Medication_Disposal/index.htm)

## Other resources:

Product Stewardship Institute:

<http://www.productstewardship.us/displaycommon.cfm?an=1&subarticlenbr=181>

Teleosis Institute: Green Health Pharmacy Program:

<http://www.teleosis.org/gpp-program.php>

