

Disposal of Pharmaceutical Residues



A Presentation to The CT Environmental Forum

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PPCPs – An Emerging Topic

- Awareness of impacts to environment is only beginning to develop:
 - ◆ PPCPs are ubiquitous.
 - ◆ Low acute toxicity.
- A common practice is to flush down the toilet or sink.
- Healthcare facilities required to render controlled substances “unrecognizable and unrecoverable” to prevent illegal diversion.
- Topic has high public visibility and continues to attract media attention.



The First Signs of a New Problem

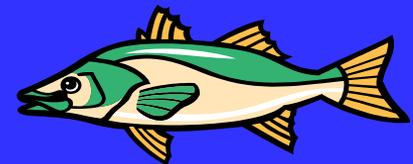
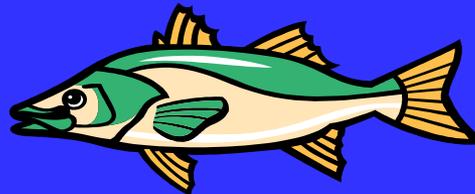
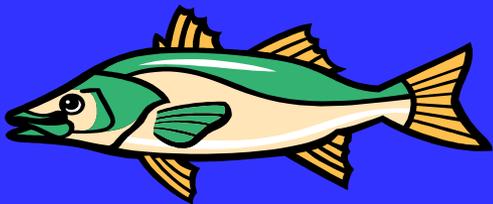
USGS Monitoring Studies in 2002 and 2004

- Numerous unregulated chemicals found as trace contaminants in surface waters across the U.S.
- Many from consumer usage.
- Probably represent a fraction of all PPCPs that are actually in the environment.
- Data demonstrate the potential for ANY consumer-use chemical to enter the environment.
- More recent studies...

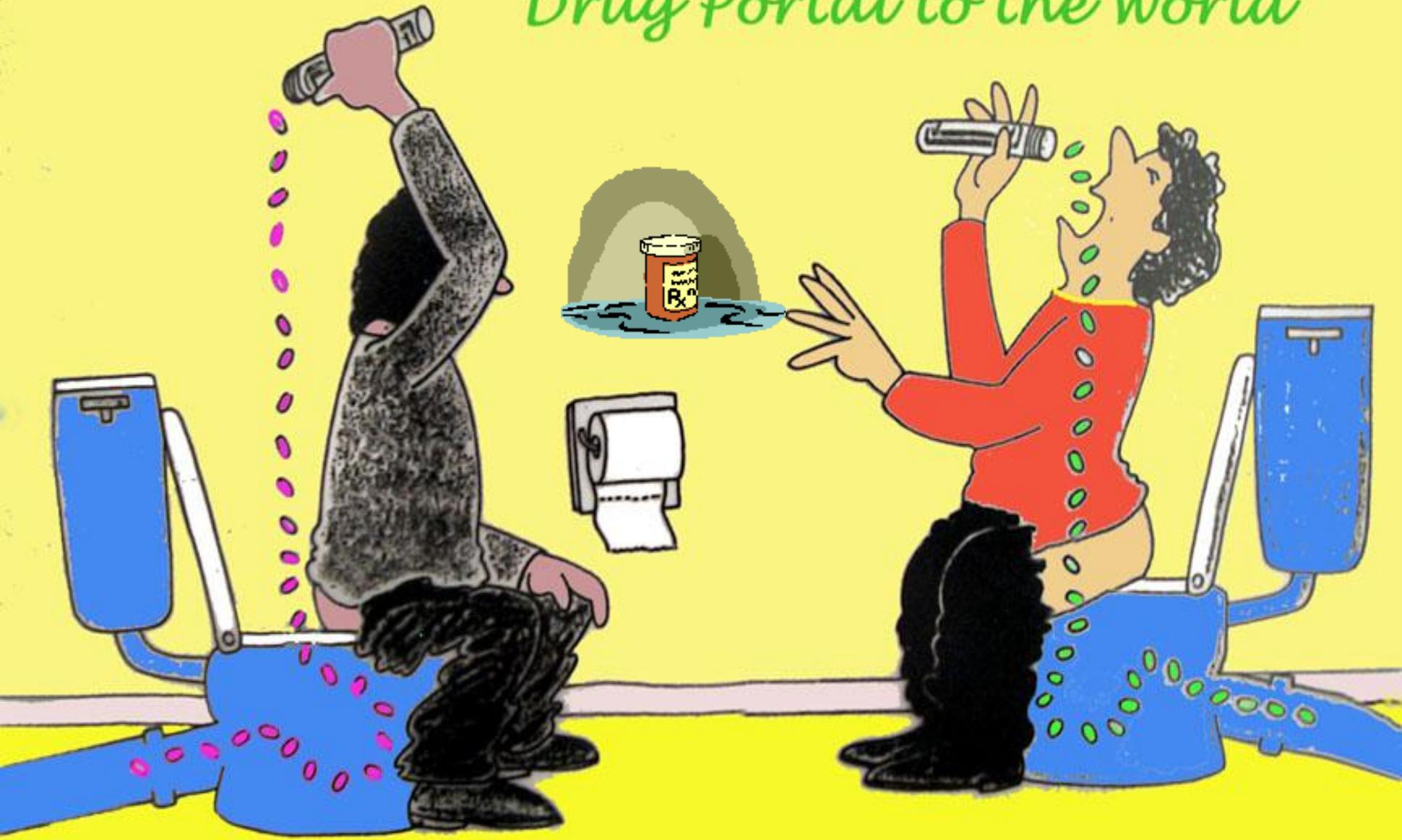


How do PPCPs get into the water?

- Excreted through urine and feces [drug or metabolites] .
- Disposed down toilet or drain .
- Not treated in municipal sewage treatment facilities .
- Discharged to receiving surface waters untreated .
- Leached to groundwater untreated from septic systems.



Drug Portal to the World



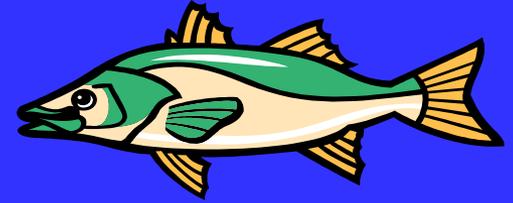
adapted by Daughton from Ternes (April 2000)

And More...

- Leaching from municipal landfills.
- Runoff from concentrated animal feeding operations.
- Loss from aquaculture.
- Spray-drift from agriculture.
- Direct discharge of raw sewage.
- Discharge from cruise ships.
- Illegal “clan” labs (especially methamphetamine).
- Direct discharge via externally applied PPCPs.

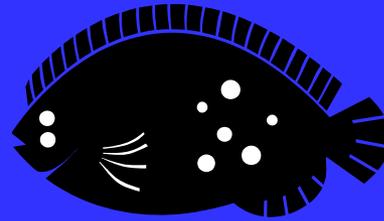


Documented Effects on Aquatic Organisms



- Aquatic life is subject to continual, life-cycle exposure.
- Drugs are being detected in aquatic tissues such as estrogens, gemfibrozil, diclofenac and fluoxetine.
- Feminization of fish - Jamaica Bay, NY and elsewhere.
- Dramatic inhibition of sperm activity in certain aquatic organisms by calcium-channel blockers.
- Profound effects on development, spawning, and other behaviors in aquatic organisms by antidepressants.

LIS Winter Flounder Study



- Three year study of late pre-spawning winter flounder.
- Results: Poor reproductive success has been shown in Boston Harbor and Long Island Sound. No correlation to metals or PCBs. Authors of the study concluded the cause to be organic contaminants or a combination of pollutants.

Other Possible Effects of PPCPs

- Can harm “bugs” required to treat waste water at municipal wastewater treatment facilities.
- Low levels of chemicals that mimic developmental hormones such as estrogen, testosterone, and thyroid may cause problems in the fetus and newborn.
- Infertility-low sperm counts (50% reduction since 1939).
- Hormonally triggered human cancers.
- Neurological disorders in children.
- Hyperactivity, attention deficit disorder, lowered IQ

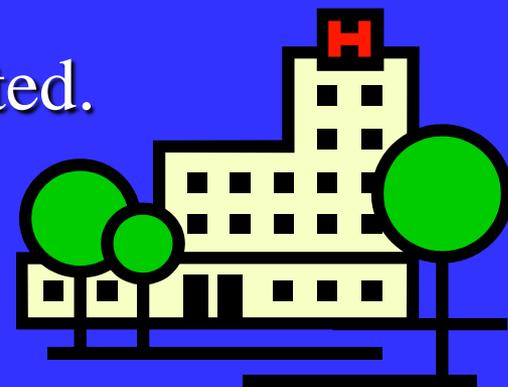
Current Trends Point to Increase in Effects of PPCPs

- Aging population.
- Growing numbers of drugs and new targets
- Individualized therapy.
- Nutraceuticals; functional foods.
- Lifestyle and cosmetics.
- Technology improvements allow detection of PPCPs at ppb and ppt levels.



EPA Hospital Initiative

- Hospitals encouraged to perform audits and self-disclose violations.
- 41 Hospitals disclosed so far (26 multimedia, 13 EPCRA-only, 1 CAA-only, 1 SPCC-only).
- 11 of the 41 were in CT.
- RCRA violations commonly reported.
- Most common RCRA violations:
 - ◆ Inadequate waste identification.
 - ◆ Labeling, etc.
- EPA has and will continue to inspect hospitals that did not go through the audit/disclosure process.



CT Proposed Legislation



- 2009 HB 5144:
 - ◆ CT DEP to develop and maintain list of prohibited prescription medications that would be banned from discharge to public or private wastewater treatment facilities by hospitals, nursing homes or other related institutions. Gave DEP authority to develop regulations, and take enforcement action with penalties up to \$30,000.
 - ◆ Did not pass, but could return in a future legislative session.
- Washington, Maine, Illinois already have similar laws.

How Are Waste Pharmaceuticals Regulated?

- Solid Waste/Special Waste: majority incinerated at local Trash-to-Energy Plants.
- Biomedical Waste: includes chemotherapy wastes and sharps.
www.ct.gov/dep/cwp/view.asp?A=2718&Q=325340
www.ct.gov/dep/lib/dep/p2/institution/biomedical_waste.pdf
- “Connecticut Regulated Waste” or Non-RCRA Hazardous Waste: includes chemical solids or liquids from any industrial, commercial, agricultural, or community activity
- Hazardous Waste: includes RCRA waste generated in industrial, commercial or healthcare sectors (excludes household hazardous waste).
- DEA Controlled Substances: narcotics (morphine, fentanyl, oxycodone, etc.): subject to special rules.



Solid Waste/Special Waste

- Consumer-generated pharmaceuticals.
- RRFs with DEP-approved WAPs allowing them to accept “contraband” may be able to take certain pharmaceuticals.



Guidance for Consumers

- Do not flush prescription medicines or OTC products down the sink or toilet.
- The best way to dispose of prescription medicines and OTC products is to put them in the trash.
- Follow (NEW) CT DEP guidance posted on web:
www.ct.gov/dep/lib/dep/p2/individual/consumerpharmdisposalfactsheet.pdf
- See Quick Reference Chart For Disposal Of Medical Supplies on website:
www.ct.gov/dep/cwp/view.asp?Q=335480&A=2708





How to Dispose of Prescription Medicines & Over-The-Counter (OTC) Products

Are you throwing away unused medications and over-the-counter products down the toilet or the sink? STOP!

Flushing medications down the toilet or sink causes water pollution, impacts drinking water and has adverse effects on septic systems, fish and other aquatic wildlife.

The safe way to dispose of medications and OTC products is to put them in the trash.

Here's how to do it:

1. Keep the medication in its original container.

- To protect privacy and discourage misuse of the prescription, cross out the patient's name with a **permanent marker or duct tape or remove the label.** (Chemotherapy drugs may require special handling. Work with your healthcare provider on proper disposal options for this type of medication.)



2. Modify the medications to discourage consumption.



- For solid medications, such as pills or capsules: add a small amount of water to at least partially dissolve them.
- For liquid medications: add enough table salt, flour, charcoal, or nontoxic powdered spice, such as turmeric or mustard to make a pungent, unsightly mixture that discourages anyone from eating it.
- For blister packs: wrap the blister packages containing pills in multiple layers of duct or other opaque tape.

3. Seal and conceal.

- Tape the medication container lid shut with packing or duct tape.
- Place it inside a non-transparent bag or container such as an empty yogurt or margarine tub to ensure that the contents cannot be seen.
- **Do not** conceal medicines in food products because animals could inadvertently consume them.



4. Discard the container in your trash can. *Do not put the container in your recycling bin!*



For more information, please contact:
Connecticut Department of Environmental Protection, Office of Pollution Prevention
79 Elm Street, Hartford, CT 06106 (860) 424-3297 www.ct.gov/dep/p2

The CT DEP thanks the Minnesota Office of Environmental Assistance for permission to use parts of their brochure.

Last Updated March 21, 2007

Consumer Collections

- 9/30/06 – Simsbury, CT.
- 9/22/07 – Winsted, CT.
- 4/25/09 – Southington, CT.
- Sponsored by local watershed associations (FRWA, SBWA) or Local Water Depts.
- First two done with funding from EPA, through NERC.
- HHW GP being modified to address pharmaceutical collection events.



Connecticut-Regulated Wastes

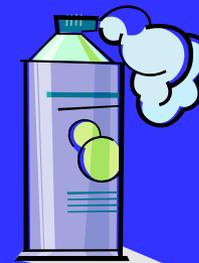
- Non-hazardous pharmaceuticals generated in hospitals, clinics, veterinary facilities, etc.

- ◆ Solids (pills, powders, patches).



- ◆ Liquids (oral, IV, IM, topical, aerosols).

- ◆ Contained gases.



Hazardous Waste

- P-listed (“Acutely hazardous”) chemicals:
 - ◆ Sole active ingredient.
- U-listed commercial chemical products:
 - ◆ Sole active ingredient.
- Characteristic hazardous wastes:
 - ◆ Ignitability
 - ◆ Corrosivity
 - ◆ Reactivity
 - ◆ Toxicity





Examples of P-Listed Pharmaceutical Wastes

➤ <i>Arsenic trioxide</i> *	P012
➤ Epinephrine ¹	P042
➤ Nicotine	P075
➤ Nitroglycerin ²	P081
➤ Phentermine (CIV)	P046
➤ Physostigmine	P204
➤ Physostigmine Salicylate	P188
➤ Warfarin >0.3%	P001

¹ CT regulates medical formulations of unused epinephrine & its salts. Considering adding to universal waste rule in future.

² CT regulates waste nitroglycerin. With adoption of changes to mixture and derived-from rules, medical formulations may not be hazardous wastes in future. Planned adoption late 2009.



Examples of U-listed Pharmaceutical Wastes

- | | | | |
|-------------------------------|------|---------------------------|------|
| ➤ Chloral Hydrate(CIV) | U034 | ➤ <i>Streptozotocin</i> * | U206 |
| ➤ <i>Chlorambucil</i> * | U035 | ➤ Lindane | U129 |
| ➤ <i>Cyclophosphamide</i> * | U058 | ➤ Saccharin | U202 |
| ➤ <i>Daunomycin</i> * | U059 | ➤ Selenium Sulfide | U205 |
| ➤ <i>Diethylstilbestrol</i> * | U089 | ➤ <i>Uracil Mustard</i> * | U237 |
| ➤ <i>Melphalan</i> * | U150 | ➤ Warfarin<0.3% | U248 |
| ➤ <i>Mitomycin C</i> * | U010 | | |

➤ ***Eight chemotherapy agents are U-listed; one is P-listed.**

Examples of Characteristic HWs

- Ignitable: Rubbing Alcohol.
- Corrosive: Compounding Chemicals.
 - ◆ Glacial Acetic Acid.
 - ◆ Sodium Hydroxide.
- Reactivity: Nitroglycerin.
- Toxic:
 - ◆ Metals: Arsenic, Barium, Cadmium, Chromium, Mercury (Thimerosal), Selenium, Silver.
 - ◆ VOCs: Chloroform.
 - ◆ SVOCs: m-Cresol.
 - ◆ Pesticides: Lindane.





Hazardous Waste Generation Status in CT

(40 CFR 261 & 262, RCSA 22a-449(c)-101 & -102)

- **Large Quantity Generator (LQG)**: (1) generates more than 1000 kg/month of hazardous waste or 1 kg/month “P” listed waste, OR (2) accumulates more than 1000 kg of hazardous waste at any one time.
- **Small Quantity Generator (SQG)**: Generates between 100 and 1000 kg/month of hazardous waste & no more than 1 kg/month “P” listed waste. Accumulates no more than 1000 kg at any one time.
- **Conditionally Exempt Small Quantity Generator (CESQG)**: Generates no more than 100 kg hazardous waste/month and no more than 1 kg “P” listed waste/month. Accumulates no more than 1000 kg at any one time.



Universal Waste (“UW”)

- EPA has proposed to create a new category of UW for pharmaceuticals.
- Proposed Rule: 12/2/2008, 73 FR 73520 – 73544:
www.epa.gov/osw/hazard/wastetypes/universal/pharm.htm
- CT DEP submitted comments supporting the proposal:
www.regulations.gov/search/Regs/contentStreamer?objectId=09000064809011a5&disposition=attachment&contentType=xml
- DEP believes chemo agents should be added as a group.
- Designation as UW would greatly facilitate the proper management of both consumer and non-consumer pharmaceutical wastes.



CT DEP Pharmaceutical Waste Policies

- In general: Don't Flush! Some wastes may be suitable for disposal to sewers:
 - ◆ Saline, glucose solutions, etc. that do not contain pharmaceuticals.
 - ◆ MISC GP or other permit required.
- Epinephrine Salts (P042) – Hazardous Waste (EPA policy letter DNA in CT).
- Unused Nicotine Patches – Hazardous Waste.
- Unused Nitroglycerine Patches – Hazardous Waste ... *for now* (no longer HW as of next CT HW reg update).



CT DEP Pharmaceutical Waste Policies

- Used Nicotine and Nitroglycerine Patches – Not Hazardous Waste.
- Agree with EPA policy that partially-used syringes are not HW (but this policy DNA to other delivery systems).
- Some non-hazardous solid pharmaceuticals may be disposed of at RRFs with DEP-approved WAPs (“contraband” category).
- Encourage use of automation to reduce generation of waste.

Pharmwaste Challenges

- HW Determinations.
 - ◆ Multiple names for pharmaceuticals.
 - ◆ U and P lists.
 - ◆ Toxicity: trace ingredients:
 - ◆ Chromium, Selenium (vitamins, etc.).
 - ◆ Phenol (preservative).
 - ◆ Thimerosal (preservative).
 - ◆ Commercial software available (PharmEcology, Stericycle, others).
- Empty “P” containers = HW.
- Compliance with DOT requirements.

Pharmwaste Challenges

- Easy for Hospitals to become LQGs (epinephrine is acutely toxic).
- Complying w/ satellite accumulation rules.
 - ◆ Partially-used epinephrine IV bags.
 - ◆ Common areas on floors or in wards.
- EPA policy re return centers based on a faulty assumption (recycling).
- Almost all return centers are not TSDFs.
- Controlled substances.

Useful Tools for Compliance

- **CHER Presentation by Charlotte Smith, PharmEcology:**

www.ct.gov/dep/lib/dep/p2/institution/pharmaceutical_waste.pdf

- **Hartford Hospital Pharm. Mgmt. Program:**

www.ct.gov/dep/lib/dep/p2/institution/hhrevisedpresentation-may07.pdf

- **CHER website:**

www.ct.gov/dep/cwp/view.asp?A=2708&Q=323980#children

- **Florida DEP list of hazardous pharms:**

www.dep.state.fl.us/Waste/quick_topics/publications/shw/hazardous/WastePharmListLetter12_07.pdf



Sources of Assistance



- CT DEP Compliance Assistance (“COMPASS”)
 - ◆ Toll-free hotline 888-424-4193
 - ◆ www.ct.gov/dep
- Ross Bunnell, WEED, 860-424-3274 or ross.bunnell@ct.gov
- Connie Mendolia, Office of Planning and Program Development, Pollution Prevention, 860-424-3243
- Christopher Malik, Bureau of Water Protection and Land Reuse, Watershed Management, 860-424-3959

Questions/Comments

