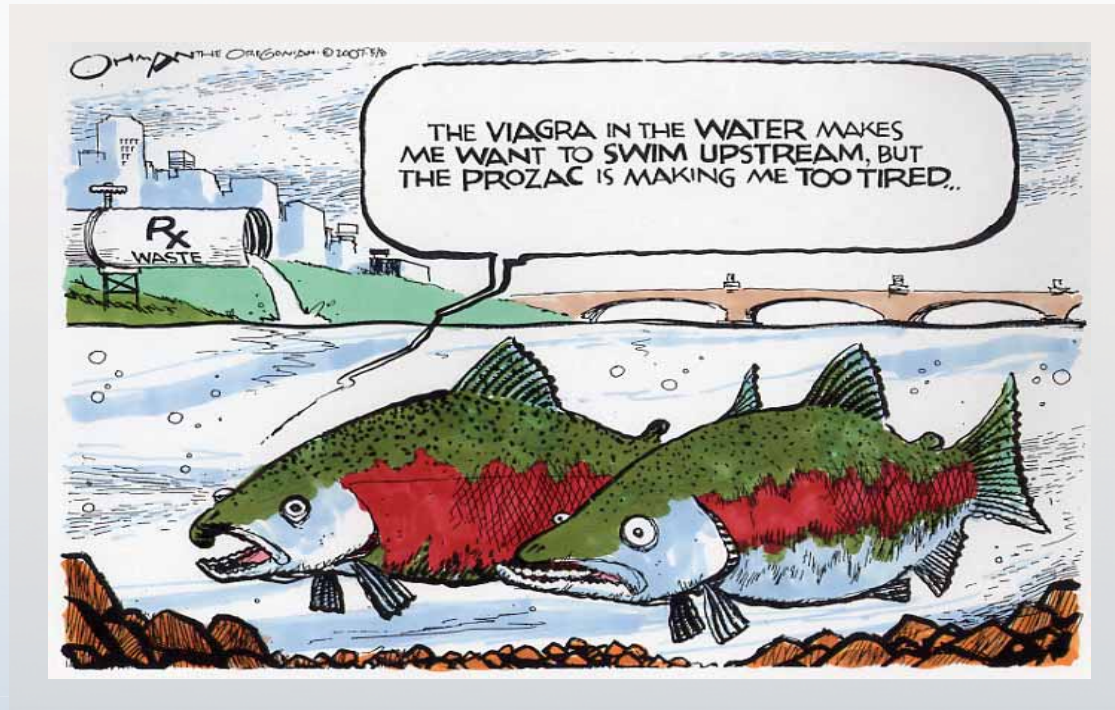


Keeping Pharmaceuticals Out of the Water



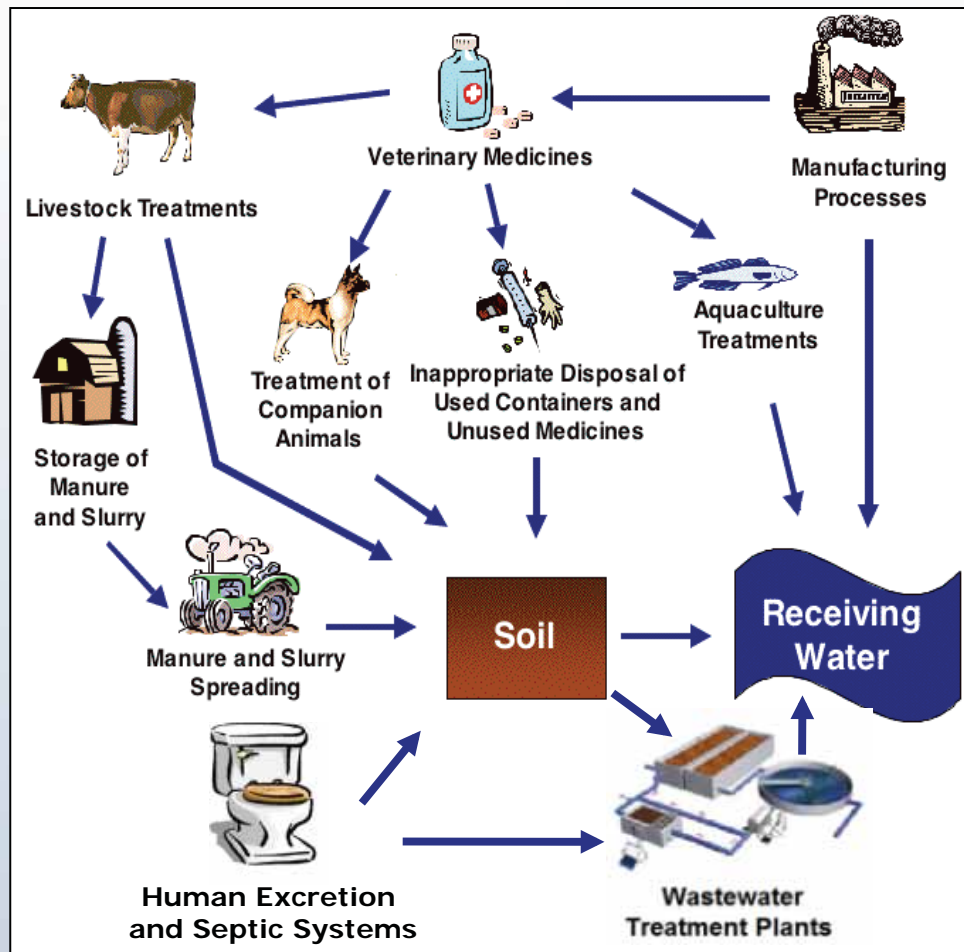
Illinois Lakes Management Association Conference
1 March 2012



Laura Kammin, Pollution Prevention Program Specialist, Illinois-Indiana Sea Grant



How do pharmaceuticals reach the environment?



- Effluent from wastewater treatment plants
- Surface application of manure and biosolids
- Commercial animal feeding operations and aquaculture
- Landfill leachate (direct/ wastewater treatment)
- Septic systems

Figure adapted from A. Boxall, EMBO reports Vol. 5, No. 12, 2004

How do pharmaceuticals reach the environment?



Treatment Techniques

Removal techniques:

- Longer solids retention (5-15 days)
- Filters and disinfectants (Work best in combination)
- Bacteria
- Reverse Osmosis (Expensive and produces brine)
- Ultrasound



Main Risks of Improper Storage/ Disposal

Accidental ingestion

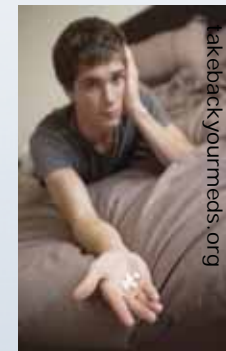
- Between 2001-2008, > 430,000 children \leq 5 yrs were seen in EDs due to poisonings from self-ingested prescription and OTC medicines.
(Journal of Pediatrics 2011)
- In 2011, the ASPCA Animal Poison Control Center received more than 25,000 calls related to pets consuming human prescription medications.



Main Risks of Improper Storage/ Disposal

Illegal use or theft

- A survey of teens found that 62% who abused prescription pain relievers said they were easily accessible through parents' medicine cabinets.



Main Risks of Improper Disposal Practices

Environmental impacts

- Continuous, multi-generational exposure to aquatic wildlife
- Impacts to terrestrial plants and animals



Pharmaceuticals in the Environment

Types of human and animal pharmaceutical chemicals identified in water bodies (Daughton and Ternes 1999):

- Hormones
- Antibiotics
- Blood Lipid regulators
- Analgesics and anti-inflammatories
- Beta-blockers
- Antidepressants
- Antiepileptics
- Antineoplastics (used in chemotherapy)
- Tranquilizers
- Retinoids
- X-ray contrast media



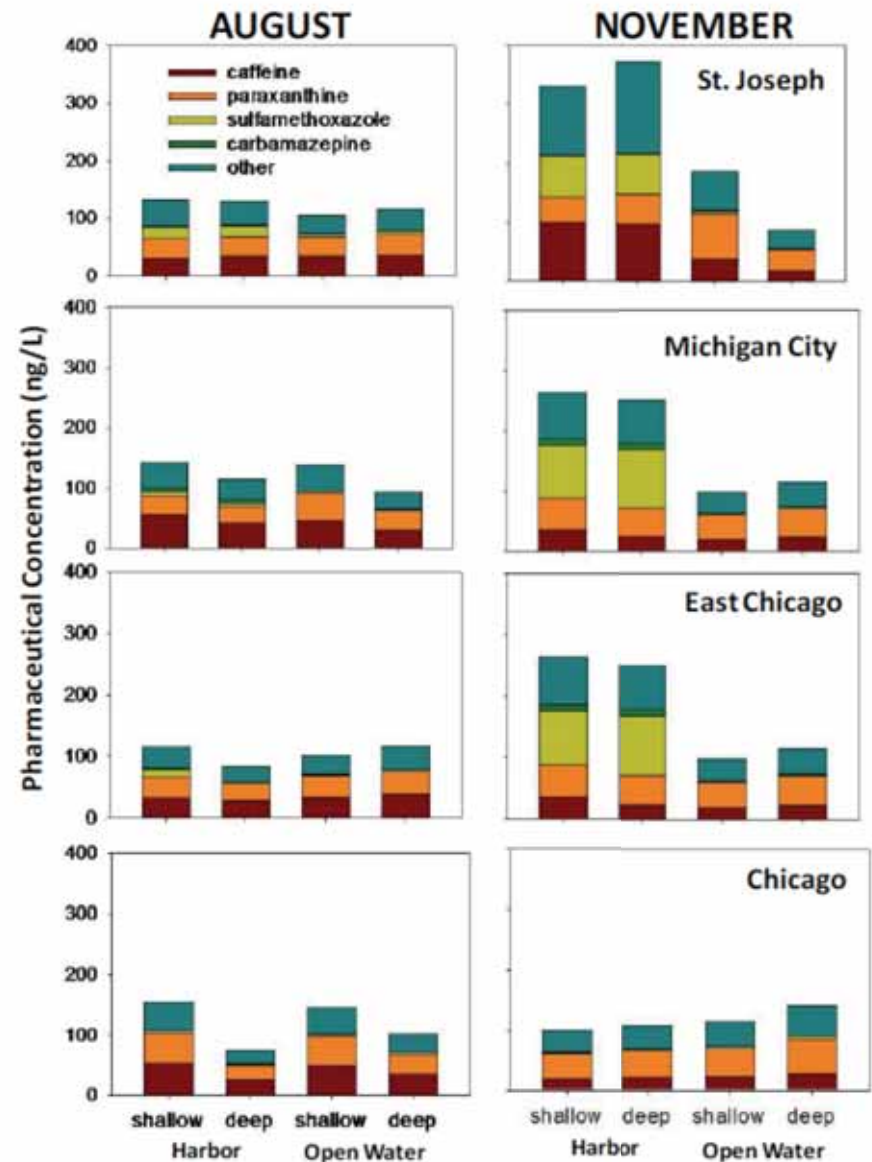
Pharmaceuticals in the Environment

Trace organics in Lake Michigan: Concentration and detection frequency of pharmaceuticals in the near-shore water column

Ball State University, Dr. Melody Bernot

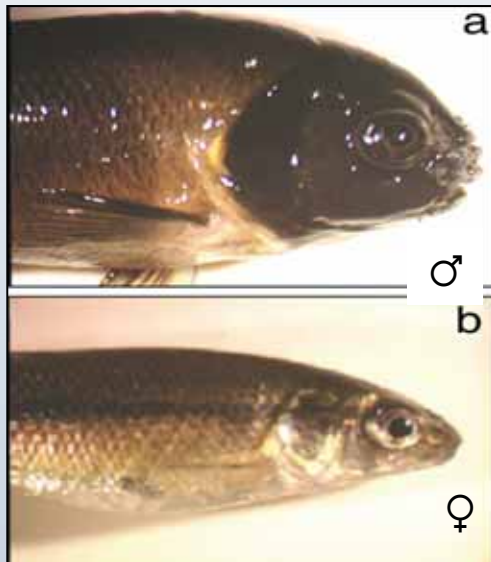
Table 1. Concentrations of pharmaceuticals detected denoted as "other" in Figure 1. Values are ranges of concentrations detected across sites separated by sampling period (August, November 2011).

Compound	Concentration Range (ng/L)	
	August	November
Acetaminophen	2.5 - 5.1	3.5 - 13.0
Cotinine	1.5 - 4.7	2.8 - 6.3
Gemfibrozil	1.0 - 10.0	1.4 - 49
Ibuprofen	1.7 - 6.9	3.5 - 30
Lincomycin	1.5 - 3.1	3.5 - 7.9
Naproxen	5.0 - 10.0	3.5 - 30
Sulfadimethoxine	0.5 - 1.0	0.7 - 1.6
Sulfamerazine	0.5 - 1.0	0.7 - 1.6
Sulfamethazine	0.5 - 1.0	0.7 - 1.6
Sulfathiazole	0.5 - 1.0	0.7 - 1.6
Triclocarban	2.5 - 10.0	3.5 - 7.9
Trimethoprim	1.5 - 3.1	3.5 - 10.0
Tylosin	1.5 - 6.7	2.8 - 6.3



Steroid Compounds

- Estrogens can have feminization effects on male fish (Nash et al. 2004, Jobling et al. 1998)
- Androgens can have masculinization effects on female fish (Ankley et al. 2003; Morthorst et al. 2010)



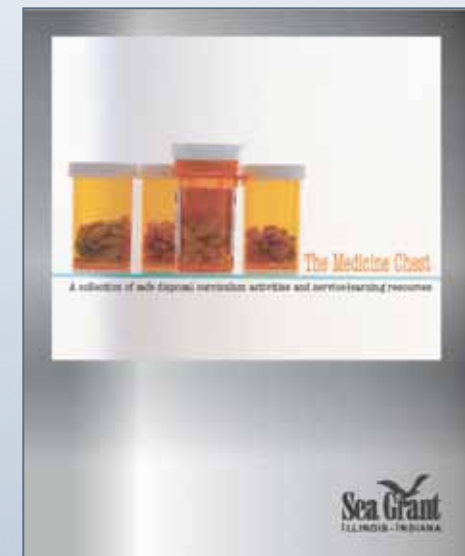
Serotonin Reuptake Inhibitors (SSRIs)

- Changes in fish and shrimp behavior
(Fluoxetine)
- Metamorphosis delays in frogs
(Fluoxetine)
- Induce mussel spawning
(Norfluoxetine/ Fluvoxamine)



Education

- *The Medicine Chest* curriculum for middle- and high-school students
- *Sensible Disposal of Unwanted Medicines* curriculum for 4-H members
- Integration of “Do Not Flush” message into displays, games, brochures, billboards, collection boxes

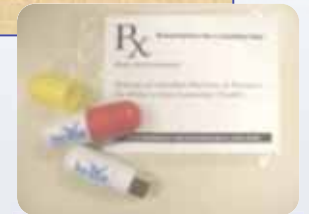
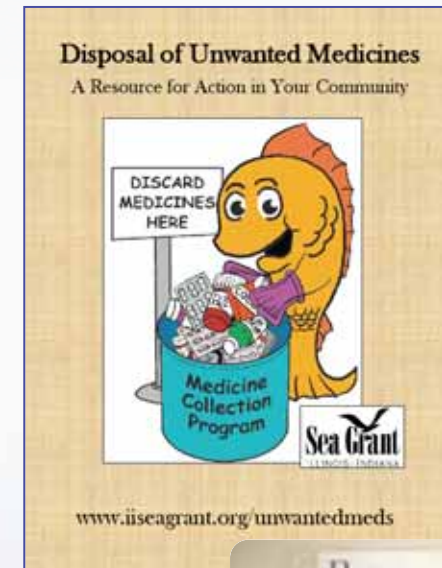


Outreach

Disposal of Unwanted Medicines: A Resource for Action in Your Community

Content:

1. Introduction to the issue
2. Case Studies of Take-Back Programs
3. How to Hold a Collection Event
4. Materials for Public Outreach and Education
5. Pharmaceutical Donation/Take-Back Legislation
6. International Policy on Medicine Donations
7. Bibliography on Pharmaceuticals, the Environment, and Human Health
8. PowerPoint Presentation



<http://www.unwantedmeds.org>

Medicine Collection Programs

- Mail-back envelopes
- DEA take-backs
 - September 2010: 121 tons
 - April 2011: 188 tons
 - October 2011: 188.5 tons
 - 28 April 2012 –Mark Your Calendar**
- Local take-back programs
 - Single-day events
 - Permanent collection programs



Single-day Events

Keep Northern Illinois Beautiful

11 June 2011, Machesney Park, IL

1,455 households participated and **5,049** pounds of medicine were collected. All cardboard and plastic was recycled.



Single-day Events

Keep Northern Illinois Beautiful

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9 June 2012 – Mark Your Calendar

Permanent Collection Programs

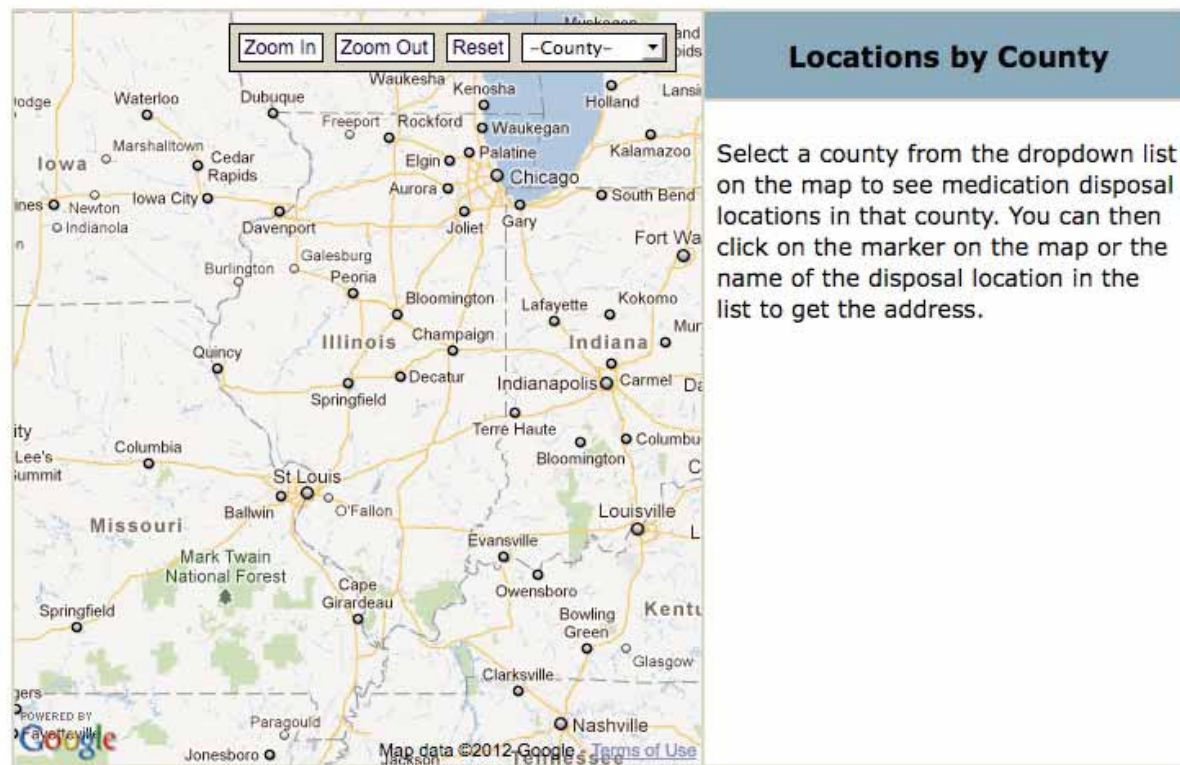
Pharmaceutical Safe Disposal Program
Monroe County, Indiana July 2011



Permanent Collection Programs

Medication Disposal

Disposal Locations



Locations by County

Select a county from the dropdown list on the map to see medication disposal locations in that county. You can then click on the marker on the map or the name of the disposal location in the list to get the address.

<http://www.epa.state.il.us/medication-disposal/locations/index.html>

Permanent Collection Programs

PROGRAM SUPPORT PROVIDED BY:

Consumers Energy
Count on Us

NMSAS
National Municipal Solid Waste Association of America
Environmental Waste Management Fund

Community Foundation
Northeast Michigan

detroit renewable power

**PUT UNWANTED MEDICATIONS IN THEIR PLACE.
YELLOW JUG OLD DRUGS®
TO KEEP OUR WATER SAFE.**

Yellow Jug Old Drugs® is a program to collect and dispose of unused/unwanted/expired drugs. To find a community-minded pharmacy in your area, go to www.greatlakescleanwater.org or call 989-736-8179.

IL Locations:
Channahon
Westmont
Oak Park
Chicago (n = 3)
Evanston

www.greatlakescleanwater.org

Take-home Messages

- Some pharmaceutical chemicals (e.g., anti-epileptics) persist
- Others are “pseudo-persistent”– They break down but are continually replaced
- Greatest concern is population-level effects: the multi-generation exposure to low-dose for small aquatic organisms



What Can You Do?



DON'T FLUSH MEDICINE



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www.unwantedmeds.org