



Pharmaceuticals and Senate Bill 1757

Jessica Huybregts
TCEQ Water Supply Division
Public Drinking Water Section
<jhuybreg@tceq.state.tx.us>
512/239-4709

Overview



- What are Pharmaceuticals?
- What is the Problem?
 - Sources and Fate in Wastewater (WW)
 - Occurrence in Water – USA and TX
 - Ecological/Human-Health Impacts
 - Drinking Water Standards
- Senate Bill 1757 Project
 - Intent and Objectives
 - Tasks for TCEQ Study Team
 - Pharmaceutical Disposal Advisory Group (PDAG)

What are Pharmaceuticals?



- Chemical or biological substances taken for the purpose of preventing, curing or reducing the symptoms of an illness or medical condition.
 - Prescription medications
 - Over-the-counter medications
 - Veterinary medications
 - Controlled substances
- Examples:
 - Antibiotics, anti-inflammatory, anti-depressants,
 - Anti-diabetics, cardiovascular drugs,
 - Reproductive hormones, thyroid hormones....



Major Sources of Pharmaceuticals in Wastewater

Medicines **consumed** &
not completely
metabolized
(or metabolized into
other forms)



Major: Excretion
Minor: Sweat & vomit

Intentional disposal of
unused drugs
(flushed down toilet
or sink)



Pharmaceuticals enter wastewater stream
(WWTP or septic systems)

Fate of Pharmaceuticals in WW



- **Conventional** WWTPs not designed to remove pharmaceuticals (but they tend to remove some).
- Some information exists on the removal of pharmaceuticals from WWTPs under **innovative** treatment technologies.
 - Eg. nanofiltration, RO, ozone, UV, and combinations
- Depending on treatment used, removal efficiencies range **1%-100%**.
 - Generally, innovative treatments remove more pharmaceuticals from water column.
 - Limited number of WWTPS employ innovative treatment technologies in Texas.

Fate of Pharmaceuticals in WW



- **Some** pharmaceuticals are removed **more easily than others** under the **same treatment** processes.
 - Eg: Complete elimination of 17-ethinylestradiol and others, yet only 20-60% removal efficiency for others (incl. ibuprofen) and carbamazepine was not removed at all (Carballa et al., 2007).
- Consequently, **pharmaceuticals may remain in water** at variable concentrations **after WW treatment**



Fate of Pharmaceuticals in WW



- → Pharmaceuticals could **discharge to surface water** (rivers, lakes) and become our **future drinking water sources**.
- → **Aquatic organisms** may also be **exposed**
- **DWTPs** have **similar issues** as WWTPs with removing pharmaceuticals.



Occurrence Data



- In USA, **significant national** studies were undertaken by USGS 1999-2002 looking at the occurrence of pharmaceuticals in water.
- Countless private and government studies since then.
- Studies **confirmed** pharmaceuticals (& other emerging contaminants) **do occur** in US waterbodies (at low concentrations).

Occurrence Data



- USGS National Stream Reconnaissance 1999/2000:
 - 139 streams tested for 'emerging contaminants'; 30 States
 - **50% streams** contained **7 or more** of the chemicals
 - Pharmaceuticals **acetaminophen** and codeine were found in **24%** and **11%** of samples, respectively.
 - Steroids and hormones were also commonly found in surface waters, with **17-ethynyl estradiol** (estrogen hormone) found in **16% of samples** analyzed.
 - **Antibiotics** were found in over **10%** of samples analyzed.
 - See Kolpin et. al. 2002.

Occurrence Data - Texas



- Some pharmaceutical occurrence data exist in TX waters:
 - South-central Texas **WWTP influent /effluent** study: most pharmaceuticals were completely removed (the **exception of carbamazepine**, an anti-epileptic) as a result of WW treatment.
 - **None detected** in **treated drinking water** supply.
 - Also found that a **hospital** contributed **12 emerging contaminants** to the WWTP.
 - North Texas **DWTP raw/treated** study:
 - A **number of pharmaceuticals** detected in **raw water** entering **DW** treatment plants.
 - However, **no pharmaceuticals** (with the **exception of** an anti-anxiety drug), were **found above detection limits** in the **treated** (finished) drinking water.
 - This study analyzed at the parts per trillion detection limit (very low).

Occurrence Data - Texas

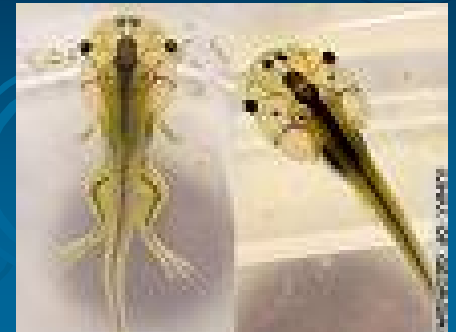


- **Fish tissue** studies conducted in **effluent-dominated** rivers in North Texas
 - **Trinity River** in Dallas part of national pilot study:
 - Among **fish liver** samples, the antidepressant norfluoxetine was **detected** in 4 of the 6 fish liver composite samples collected from the Trinity River.
 - Also detected sertraline (antidepressant) and diphenhydramine (antihistamine) in fish liver samples from Trinity River.
 - See Ramirez et *al.*, 2009



Environmental/Health Impacts

- Ecological impacts observed may impact **species survival**:
 - Feminization of fish
 - Reduced predator behaviors
 - Developmental delays (eg. tadpoles that don't grow limbs)
 - Note: aquatic life are continuously exposed
- Concerns of antibiotic-resistance in humans
- **No evidence** of adverse health effects to humans
- Clearly more research required



Applicable Water Standards



- ‘Emerging contaminants’ are currently outside the scope of the TCEQ's Drinking Water and Wastewater regulatory authority.
- Drinking Water: **No** pharmaceuticals listed in the Primary or Secondary National Drinking Water Regulations.
 - However, 10 pharmaceuticals are listed on the **Contaminant Candidate List 3 (CCL3)** – used by EPA to help determine if chemicals should be regulated in future.

Senate Bill 1757 Project



- Passed in 81st Legislative Session, 2009
- TCEQ shall study and make recommendations regarding the methods to be used by **consumers**, health care **providers**, and **others** for disposing of unused pharmaceuticals so that they do not enter a wastewater system.
- Report due to legislature December 1, 2010

Pharmaceutical Removal/Reduction from WW

TWO APPROACHES

TREATMENT APPROACH

Remove the
pharmaceuticals AFTER
they've entered the
wastewater system

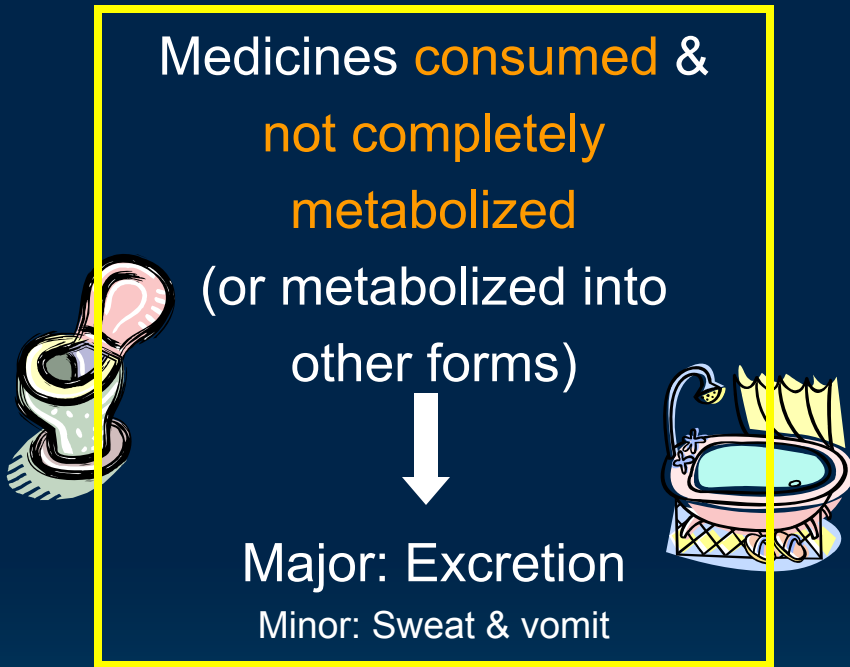
Requires improved WW
treatment tech

PREVENTION APPROACH

Prevent/reduce the
amount entering to
wastewater system

Consider non-flush
disposal options

General Intent of SB-1757



FEWER pharmaceuticals enter wastewater stream

Objectives



- Specifically, TCEQ shall consider:
 - (1) the methods currently used in Texas (by consumers, health care providers, and others);
 - (2) alternative methods used, including methods used in other states; and
 - (3) the effects on public health and the environment of the various methods used for that purpose.
 - (4) The report must also provide an analysis of the feasibility of implementing the recommended disposal methods on a statewide basis.

Intent of Advisory Group



- To provide a **forum** for **TCEQ** to **gather** appropriate and sufficient **information** to understand the:
 - **methods** currently used in Texas to dispose of unused pharmaceuticals;
 - **amount (and type)** of unused pharmaceuticals currently disposed of by various methods;
 - **factors driving** disposal practices;
 - **regional differences** in disposal practices;
 - **desires** of consumers, the health-care industry and others for alternative disposal methods; and
 - knowledge gaps.

Intent of Advisory Group



- To provide an **opportunity** for **stakeholders** to **convey** their experiences (good and bad) regarding the current methods of disposing of unused pharmaceuticals.



Some PDAG Stakeholders



- **Federal Government**
 - Drug Enforcement Administration, Houston Office
 - US Environmental Protection Agency - Region 6
- **State Government**
 - Department of Aging and Disability Services
 - Department of Public Safety of the State of Texas
 - Department of State Health Services
 - Texas Parks and Wildlife Department
 - Texas State Board of Pharmacy
- **Local Government**
 - Capital Area Council of Governments
 - Alamo Area Council of Governments
 - Houston-Galveston Area Council
 - San Antonio Water System
 - City of Austin
 - City of Round Rock
 - City of Denton
- **Water Utility-Related Groups:**
 - Lower Colorado River Authority
 - Association of Water Board Directors (Texas)
 - Texas Section American Water Works Association
 - Texas Water Conservation Association
- **Ranchers & Farmers:**
 - Texas and Southwestern Cattle Raisers Association
 - Texas Farm Bureau
 - Texas Poultry Federation
 - Texas Pork Producers
- **Educational Institutions:**
 - Baylor, Texas A&M, Texas Tech, UNT, UTMB
- **Medical Waste Processing Groups:**
 - PharmEcology
 - Sharps Compliance Inc.
 - Stericycle, Inc.
 - Texas Association of Healthcare Facilities Management
 - Texas Solid Waste Association of North America
- **Health-Care Providers:**
 - Texas Ambulance Association
 - Texas Assisted Living Association
 - Texas Association for Home Care
 - Texas Association of Community Health Centers
 - Texas Dental Association
 - Texas Hospitals Association
 - Texas Medical Association
 - Texas Organization of Rural & Community Hospitals
 - Texas Panhandle Poison Center
 - Texas Veterinary Medicine Association
- **Pharmacies & Pharmacists:**
 - National Association of Chain Drug Stores
 - Texas Federation of Drug Stores
 - Texas Pharmacy Association
 - Texas Society of Health-System Pharmacists
- **Pharmaceutical Manufacturers (members of:)**
 - Pharmaceutical Research and Manufacturers of America (PHRMA)

Advisory Group Meetings



- **Monthly**, January through June 2010.
- Next meeting on **February 26th**.
- All meetings will be at TCEQ Austin office.
 - **LiveMeeting** services will be provided at each meeting for anyone interested.
- **Webpage** lists upcoming meeting information, including dates, agendas and past meeting minutes.
- http://www.tceq.state.tx.us/permitting/water_supply/pdw/pdagroup

Advisory Group Meeting Topics



- Each meeting will have a specific topic.
- *Potentially:*
 - January: Define objectives and scope.
 - February: Discussion of current disposal practices
 - March: Complete discussion of current disposal options and introduce alternative disposal practices
 - April: Discussion of alternative disposal practices
 - May: Feasibility Considerations
 - June: Summarize findings and final considerations.

Questionnaire to Stakeholders



- To collect a **baseline** set of information documenting:
 - **how** health-care facilities/providers, consumers and others are currently disposing of unused pharmaceuticals in Texas;
 - **how much** of **what** is being disposed of via the various disposal practices; and
 - **why** certain disposal practices are chosen.



Purpose of Questionnaire



- Questionnaire chosen so that we have some data to support claims.
- Some national reports and reviews exist but little, if any, detail provided about Texas.



Questionnaire Respondents



- We are developing different questionnaires appropriate to each stakeholder type.

- (1) Public Health-Care Providers
- (2) Veterinary Care Providers
- (3) Pharmacies/Pharmacists
- (4) Waste Disposal Operations & Reverse Distributors
- (5) Pharmaceutical Manufacturers
- (6) Ranchers and Farmers
- (7) End user/consumers
- (8) Water Utilities
- (9) Local Governments

Questionnaire Respondents



- At the January 26th PDAG meeting, it was decided that some stakeholders from each group would review the questionnaires prior to sending out to their respondents.
- Stakeholders also had good questions about sample size and who else to involve/survey.



Summary



- Pharmaceuticals are removed to varying degrees in wastewater treatment. Therefore it is possible for them to enter surface waters via release of treated wastewater, and potentially become drinking water sources.
- TCEQ's cross-discipline study team is working on a response to SB-1757, due Dec. 1st, 2010.
- SB-1757 addresses methods of disposing of unused pharmaceuticals so that they won't enter a wastewater system.
- TCEQ developed the Pharmaceutical Disposal Advisory Group to help identify the current methods of disposing of unused pharmaceuticals and understand factors affecting disposal practices across Texas.

TCEQ Contacts



- **Jessica Huybregts**
 - Email: jhuybreg@tceq.state.tx.us
 - Phone: 512-239-4709

- **Elston Johnson**
 - Email: eljohnso@tceq.state.tx.us
 - Phone: 512-239-0990

- **Pharm. Disposal Advisory Group Webpage**
- http://www.tceq.state.tx.us/permitting/water_supply/pdw/pdagroup