PHARMACEUTICALS, HEALTHCARE, & THE ENVIRONMENT

Developing an EPA Compliant Pharmaceutical Program

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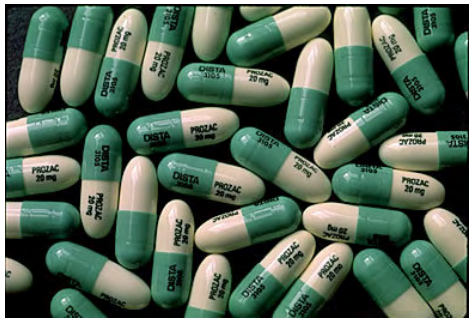
Diane Buxbaum, MPH
Compliance Assistance Section
USEPA Region 2

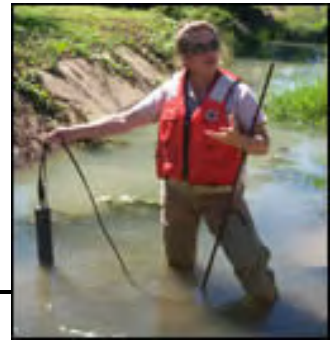


From a presentation prepared by Kathleen Malone-Bogusky

Agenda

- Public Health and Environmental Concerns
- Current EPA Requirements
- Upcoming Regulatory Developments
- Best Management Practices
- Resources

Why Are Pharmaceuticals on the Radar Screen?



- USGS detected pharmaceuticals compounds in 80% of the 139 U.S. streams sampled in 1999 and 2000;
- One very small scientific study found four pharmaceuticals (caffeine, carbamazepine, cotinine and dihydronefedipine) in finished drinking water;
- Studies have found pharmaceuticals found in leachate at three landfills in Maine and a landfill in Denmark and elsewhere.

Public Health & Pharmaceuticals

- No known human health effects from such low-level exposures in drinking water, but…
  - Special scenarios (e.g. fetuses) require more investigation;
  - Environmental toxicology focuses on acute effects of exposure rather than chronic effects;
  - Unknown cumulative & synergistic effects
- Antibiotics

Wildlife & Pharmaceuticals

- Feminization of Fish/Amphibians;
- Death of Vultures in South Asia
- Waterfleas

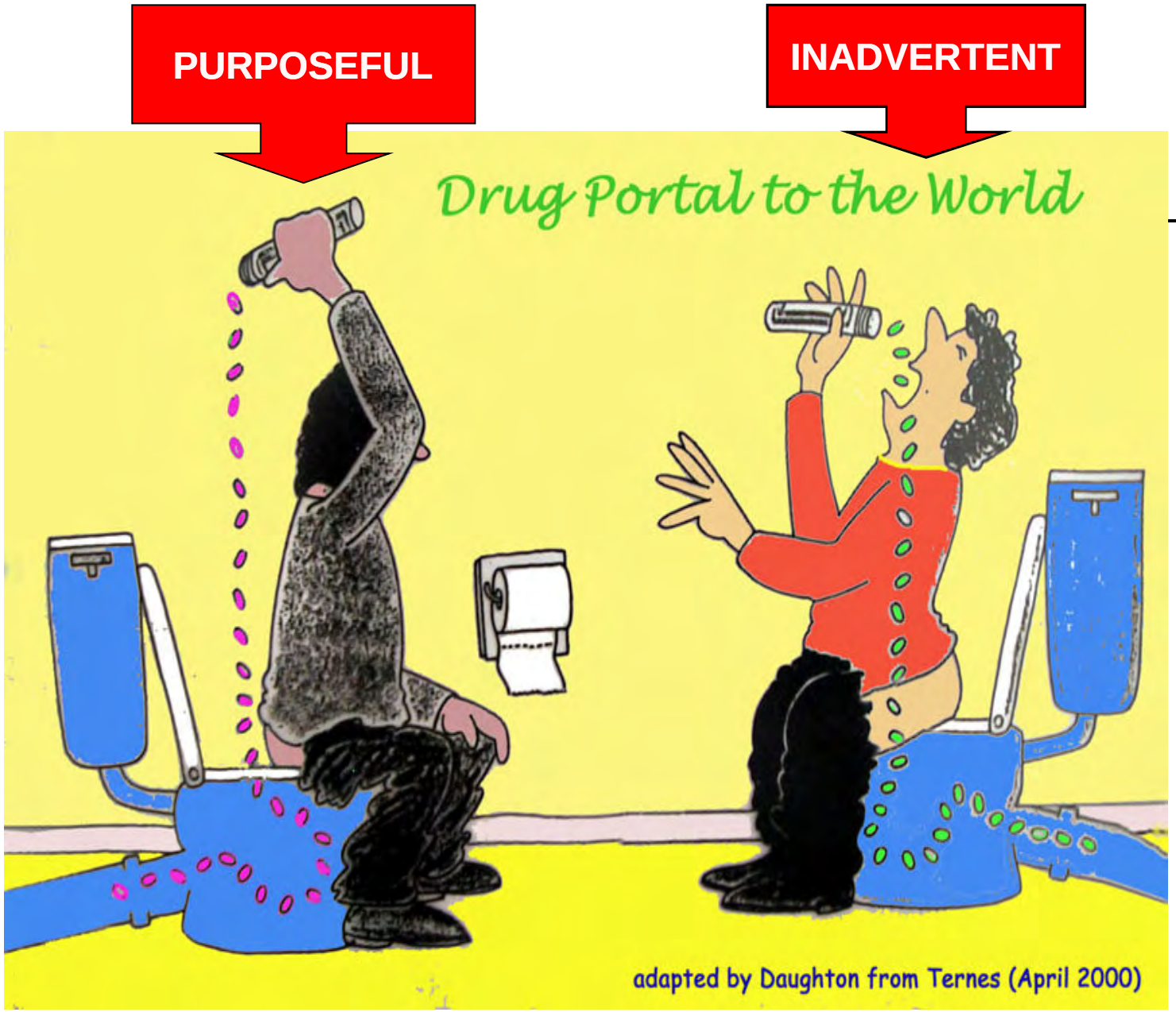
Precautionary Principle

"When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically"

- Wingspread Conference Center, Racine, WI 1998

Wastewater Treatment Plants – Are They the Answer?

- Traditionally not designed to remove pharmaceuticals;
- Even the most advanced wastewater treatment operations still discharge pharmaceuticals to receiving waters;
- Pharmaceuticals often designed to be resistant to metabolic transformation.



EPA NOT THE ONLY ACTOR

- Drug Enforcement Agency
- Department of Transportation
- Food and Drug Administration
- Federal Aviation Administration
- Occupational Safety and Health Administration
- Centers for Medicare & Medicaid Services
- State Boards of Pharmacy
- State Environmental Agencies
- Publically Owned Treatment Works

What is RCRA?

- Subtitle C of the Resource Conservation and Recovery Act (RCRA) establishes a system for controlling hazardous waste from "cradle to grave."

- 40 CFR Parts 260-272

3 STEPS to RCRA

1. Identify what pharmaceuticals are hazardous waste?
2. Determine how much hazardous waste generated in a month?
3. Based on answer to #2, follow appropriate hazardous waste management requirements

Is it a Solid Waste? (Part 261)

- A solid waste is any discarded solid, liquid, or contained gaseous material;
- Ask yourself three questions:
  - Do you have use for the material?
  - Do you treat the material as if it is a valuable commodity?
  - Are you giving it to someone else that has a use for it?

Reverse Distribution

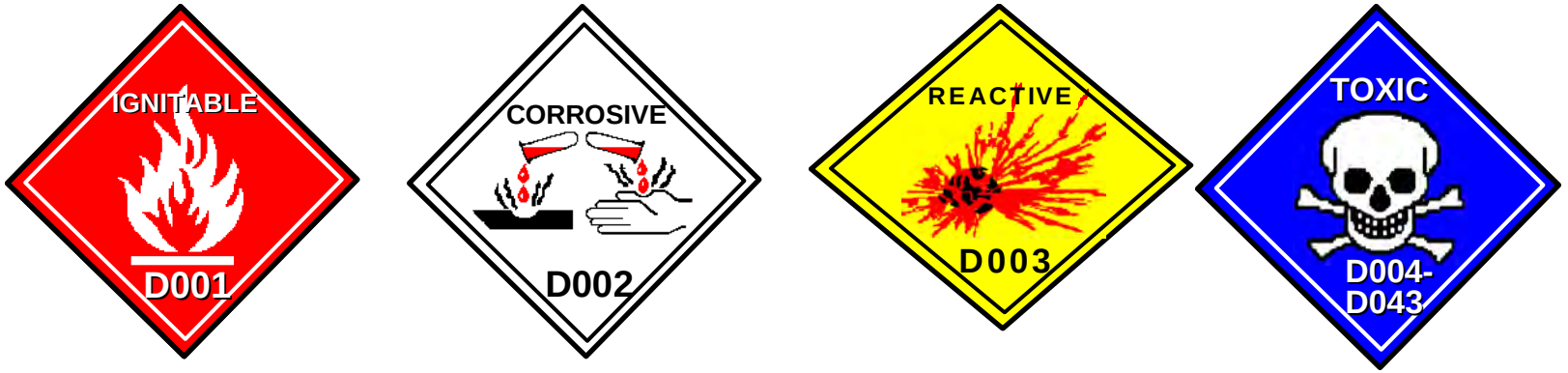
- Allows the return of unused and/or expired pharmaceuticals to the manufacturer or reverse distributor as a product
- Waste determination is made at the reverse distributor
- Prohibits the shipping of items that are known to be wastes (e.g. unused compounded IVs; partial or empty vials; used ointments; bulk chemicals or materials; outdated samples; and outdated unit-dose items)
- Policy Memos:
  - Merck – 1981
  - BFI Pharmaceutical – 1991

Solid Waste Exclusions (Part 260-261)

- Domestic sewage, and any mixture of domestic sewage and other wastes, that passes through a sewer system to a POTW for treatment (307(b) of CWA)

Is it a Hazardous Waste? (Part 261)

- Is it explicitly excluded?
- Is it listed?
- Does it exhibit a characteristic of a hazardous waste?



Household Waste Exemption

- Household wastes are not considered hazardous wastes under RCRA (e.g. wastes from doctor's housing; university dormitories; military housing)
- Nursing homes not included in exemption unless the hazardous waste is under the control of the patient or resident when discarded;
- Community take-back programs

Listed Hazardous Wastes

- Identified in 40 CFR Part 261 Subpart D
- Lists include industrial waste streams and waste commercial chemical products that typically
  - Exhibit one or more hazardous waste characteristics
  - Contain hazardous constituents
- Wastes are identified by a single letter prefix (F, K, P, or U) followed by a three digit number

P- And U-listed Wastes

- Section 261.33 lists over 350 commercial chemical products which are hazardous when discarded
  - P-listed wastes are known as acute hazardous wastes (§261.33(e))
  - U-listed wastes are known as toxic hazardous wastes (§261.33(f))

Two Necessary Conditions:

- The listed chemical is the sole active ingredient in the formulation;

AND

- The pharmaceutical waste has not been used for its intended purpose.
  - Exemption for excess or residue P- and U-listed drugs in a used syringe

P-Listed Pharmaceuticals

Constituent of Concern	Waste Code
Arsenic Trioxide	*P012*
Epinephrine Base	P042
Nicotine	P075
Nitroglycerin	P081
Phentermine (CIV)	P046
Physostigmine	P204
Physostigmine salicylate	P188
Warfarin >0.3%	P001

U-Listed Pharmaceuticals

Constituent of Concern	Waste Code
Chloral hydrate (CIV)	U034
Chlorambucil	*U035*
Cyclophosphamide	*U058*
Daunomycin	*U059*
Dichlorodifluoromethane	U075
Diethylstilbestrol	*U089*
Hexachlorophene	U132

U-Listed Pharmaceuticals

Constituent of Concern	Waste Code
Lindane	U129
Melphalan	*U150*
Mercury	U151
Mitomycin C	*U010*
Paraldehyde (CIV)	U182
Phenol	U188
Reserpine	U200

U-Listed Pharmaceuticals

Constituent of Concern	Waste Code
Resorcinol	U201
Saccharin*	U202*
Selenium sulfide	U205
Streptozotocin	*U206*
Trichloromonoflurомethane	U121
Uracil mustard	*U237*
Warfarin <0.3%	U248

Characteristic Hazardous Waste

- A solid waste is a hazardous waste (unless excluded) if it exhibits any of the characteristics of hazardous waste
  - Ignitability (D001)
  - Corrosivity (D002)
  - Reactivity (D003)
  - Toxicity (Multiple D Codes)

Characteristic of Ignitability

- A solid waste exhibits the characteristic of **ignitability** if:
  - It is a **liquid** and has a flash point less than 60°C (140°F) (aqueous solutions containing less than 24% alcohol are excluded)
  - It is **not a liquid** and is capable of causing fire through friction, absorption of moisture or spontaneous chemical changes **and** when ignited burns so vigorously and persistently that it creates a hazard
  - It is an ignitable **compressed gas**
  - It is an **oxidizer**

Examples of Pharmaceuticals with Ignitability Characteristics

- Erythromycin Gel 2%
- Texacort Solution 1%
- Taxol Injection
- Flexible Collodion
- Potassium permanganate
- Primatene aerosol

Characteristic of Corrosivity

- A solid waste exhibits the characteristic of **corrosivity** if:
  - It is aqueous and has a pH of <2 or >12.5
  - It is a liquid and corrodes steel at a rate > 6.35 mm (0.25 in) per year at a temperature of 55°C (130°F)

Examples of Pharmaceuticals with Corrosive Characteristics

- Glacial acetic acid with pH less than or equal to 2
- Sodium hydroxide with pH greater than or equal to 12.5

Characteristic of Reactivity

- A solid waste exhibits the characteristic of **reactivity** if:
  - It is normally unstable and readily undergoes violent change without detonation
  - It reacts violently with water
  - It forms potentially explosive mixtures with water
  - It generates toxic gases, vapors, or fumes in dangerous quantities when mixed with water
  - It is a cyanide- or sulfide-bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in dangerous quantities
  - It is capable of detonation or explosive reaction if subjected to strong initiating sources or if heated under confinement
  - It is readily capable of detonation, explosive decomposition, or reaction at standard temperature and pressure (STP)
  - It is a Forbidden, Class A, or Class B Explosive

Characteristic of Toxicity

- A solid waste exhibits the characteristic of **Toxicity** if:
  - The Toxicity Characteristic Leaching Procedure (TCLP) defines it as toxic
  - The TCLP measures how much contamination would drain (leach) from waste and pollute groundwater

D-Listed Chemicals Used in Drug Formulations

Chemical	Conc. (mg/l)	Waste Code	Drug Formulations Containing Chemical
Arsenic	5.0	D004	Arsenic trioxide
Barium	100.0	D005	Barium Sulfate
Cadmium	1.0	D006	Multiple mineral preparations
Chromium	5.0	D007	Multiple mineral preparations
Lindane	0.4	D013	Treatment of Lice, scabies
M-cresol	200.0	D024	Preservative in human insulins
Mercury	0.2	D009	Vaccines with thimerosal, eye, ear preparations
Selenium	1.0	D010	Dandruff Shampoo, multiple mineral preparations
Silver	5.0	D011	Silver sulfadiazine cream

Mixtures

- If a mixture contains a characteristic hazardous waste or a listed hazardous waste that is listed solely because it exhibits a characteristic, the mixture will only be considered hazardous if it continues to exhibit the characteristic;
- All other mixtures containing hazardous waste will continue to be hazardous when discarded.

A Container Is "Empty" If:

- For compressed gas, the pressure in container = atmospheric pressure
- For P-Wastes, the container or inner liner is:
  - Triple rinsed & rinsate managed as a P-waste
  - Cleaned using equivalent method
  - Inner liner removed
- For other hazardous wastes, the container or inner liner is:
  - Emptied as much as possible using common practices;

    AND
  - No more than the following amounts remain:
    - 2.5 cm, or
    - 3.0% by weight (if container < 110 gallons), or
    - 0.3% by weight (if container > 110 gallons).

Personal Protective Equipment and Spill Materials

- If contaminated with a characteristic hazardous waste or a listed hazardous waste that is listed solely because it exhibits a characteristic, do not need to be managed as a hazardous waste if they no longer exhibit a characteristic.
- All other contaminated PPE & spill materials are considered hazardous waste when discarded.

Three Tiers of Generators

- Conditionally-Exempt Small Quantity Generator (CESQG)
- Small Quantity Generator (SQG)
- Large Quantity Generator (LQG)

CESQGs

- Produce < or = 100 kg/mo of non-acute hazardous waste
- Produce < 1 kg/mo of acute hazardous waste;
- Produce < 100 kg/mo of residue or contaminated soil, waste, or other debris from spill clean-up of acutely hazardous waste

SQGs

- Produce between 100 kg and 1000 kg/mo of non-acute hazardous waste
- Produce < 1 kg/mo of acute hazardous waste
- Produce < 100 kg/mo of residue or contaminated soil, waste, or other debris from spill clean-up of acute hazardous waste

LQGs

- Produce >= 1000 kg/mo of non-acute hazardous waste
- Produce >= 1 kg/mo of acute hazardous waste
- Produce >= 100 kg/mo or residue or contaminated soil, waste, or other debris from spill cleanup of acute hazardous waste

Regulation Status is Determined on a Month-to-Month Basis

- A generator may produce less than 100 kg in January but greater than 1000 kg in February
  - January - CESQG
  - February – LQG
- During the LQG months, the full set of Subtitle C rules applies and facility is subject to applicable annual reporting requirements for that year

Generator Status

- Most hospitals are SQGs;
- P-Listed wastes may cause some hospitals to be LQGs;
- Remodeling X-ray areas (lead shielding discarded) or periodic storage room cleanouts can result in a LQG classification.

Requirements for SQGs: Obtaining an EPA ID Number

- EPA ID numbers can be obtained from EPA Region 2 offices: call (212) 637-4106
- EPA and states use these 12-character numbers to monitor and track waste activities
- You will need the number when you send waste off site to be managed

Requirements for SQGs: Quantity and Time Limits

- SQGs can accumulate on site at one time:
  - Up to 6,000 kg or 13,200 lbs of non-acute hazardous wastes;
  - Less than 1 kg of acutely hazardous waste;
  - Less than 100 kg of spill debris.
- SQGs can store waste no more than 180 days (270 days if TSDF is more than 200 miles away)

Requirements of SQGs: Main 180-day HW Storage Area

- Must keep HW containers closed (except when adding or removing waste); in good condition and secured from failure.
- Must label HW containers with:
  - "Hazardous Waste"
  - Specific description of contents
  - Date on which accumulation began
- Must conduct weekly inspections with log book entries

Requirements of SQGs: Satellite Accumulation Areas

- May accumulate 55 gallons of HW or one quart of acute HW in containers at or near generation point and under the control of the operator of the process generating the waste;
- The container must be closed (except when adding/removing wastes); be in good condition; and compatible with its contents.
- The container is marked either with the words “Hazardous Waste” or with other words that identify the contents of the container;
- 3 days to move wastes to main storage area

Requirements of SQGs: Emergency Planning

- Adequate internal alarm/communication system;
- An Emergency Coordinator who is on the premises or on-call at all times;
- Emergency response info posted by phone;
- Adequate aisle space for emergency response and water for fire fighting;
- Properly maintained emergency equipment & supplies
- Advanced emergency arrangements

Requirements for SQGs: Training & Waste Minimization

- All employees must be thoroughly familiar with proper waste handling and emergency procedures;
- A good faith effort to minimize waste generation and to select the best available waste management must be undertaken.

Requirements for SQGs: Maintenance and Operation

- All generators must maintain and operate their facilities to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water, which could threaten human health or the environment.

Requirements for SQGs: Shipping Wastes Offsite

- SQGs must send HW to TSDF or recycling facility;
- SQGs must ensure HW shipments are properly packaged, labeled, marked, and placarded to DOT regulations (usually done by transporter)
- SQGs must prepare HW manifests correctly, keep all copies for at least 3 years, track signed TSDF copies, sign a certification of HW minimization on the manifest and send copies where required on form.
- SQGs must ensure HW meets the Land Disposal Restrictions (LDR) requirements and the receiving TSDF is sent a completed LDR form

Upcoming Regulatory Developments

- Proposal to Add Pharmaceuticals to Universal Waste Rule
  - Proposed Rule (12/2/2008)
  - Final Rule is unknown
  - Best Management Practices Guide for Pharmaceuticals
  - EPA's Office of Water
  - Address hospitals and long-term care facilities
  - Expected FY 2011

Best Management Practices

- Maintain a detailed pharmaceutical inventory (preferably electronic)
- Implement stock rotation
- Minimize product sample waste
- Reduce amount of drugs dispensed to patients and residences at one time
- Utilize bar code scanner to communicate proper disposal method to staff

Best Management Practices

- Treat as hazardous waste:
  - Formulations with a listed active ingredient that is not the sole active ingredient;
  - All chemotherapeutic agents;
  - Drugs meeting NIOSH hazardous drug criteria
  - Drugs listed in Appendix VI of the OSHA Technical Manual
  - Drugs with LD50 <= 50 mg/kg
  - Carcinogenic Drugs
  - Combination Vitamin/Mineral Preparations with Heavy Metals
  - Endocrine Disrupters

Best Management Practices

- Incineration of drugs preferred method of disposal.
- Eliminate Drain Disposal
- Avoid landfilling for both environmental and security reasons

Resources

- **EPA's Pharmaceutical and Personal Care Products Website www.epa.gov/ppcp**
- **Healthcare Environmental Resource Center www.hercenter.org**
- **Practice Greenhealth www.practicegreenhealth.org**
- **EPA Region 2's Healthcare Website www.epa.gov/region02/capp/healthcare**
- **New York State Pharmaceutical Page www.dec.ny.gov/chemical/45083.html**

Contacts

- Diane Buxbaum, EPA Region 2
  - (212) 637-3919
  - buxbaum.diane@epa.gov
- Kathleen Malone-Bogusky, EPA Region 2
  - (215) 637-4083
  - malone.kathleen@epa.gov