



Overview of Environmental Impacts

Unified Green Cleaning Alliance

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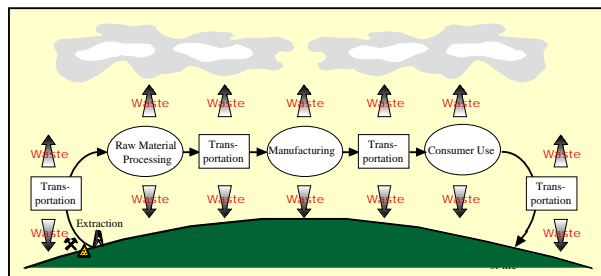
Consumption of Detergent and Cleaning Products

- In the U.S., billions of pounds of ingredients handled and released into the environment each year
- In Europe, institutional cleaning products consume more than 200 thousand tons surfactants
- ~118 million pounds of general purpose cleaners used in Canada
- Diversity of products to perform basic cleaning tasks is growing



Consider the Life Cycle

- Raw Materials (extraction)
- Processing and Manufacture
- Final packaged product
- Use
- Disposal



9/6/01

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Raw Materials Extraction

- Organic Feedstock
 - petroleum
 - plant
 - animal ingredients
- Energy consumption
- Impacts from mining - Phosphates, Silicates, and Carbonates used as builders



(Sinkhole in New Wales Gypsum Stack - AP Photo/Selbypic)

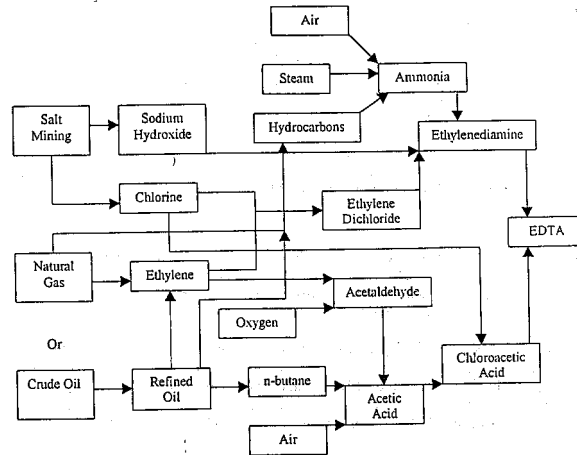
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Manufacturing Processes - BYPRODUCTS AND TOXIC RELEASES

- Surfactants
 - APEs
- Builders
 - EDTA
- Solvents
 - Glycol Ethers



Packaging and Distribution

- PVC
- Waste
 - Recyclable
 - Biodegradable
 - Energy recovery





$$\text{Risk} = \text{Hazard} \times \text{Exposure}$$



Use and Disposal : Environmental Exposure Routes *AIR*

- Volatile Organic Compounds (VOCs)



- Indoor Air Quality
 - Remove Biological Contaminants without introducing Chemical Pollutants (VOCs)



- Outdoor Air Quality
 - Ground-level Ozone
 - Smog





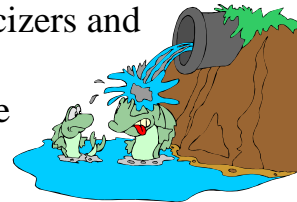
Use and Disposal: Environmental Exposure Routes *WATER*

- USGS Study
- Water Treatment Facilities



First Nationwide Reconnaissance: Organic Wastewater Contaminants in U.S. Streams

- Analyzed for 95 industrial, human and agricultural potential contaminants in 139 streams. Many sites were likely sources.
- Classes with the highest concentrations detected included detergent metabolites, plasticizers and steroids.
- A median of 7, maximum of 39, of the analyzed contaminants were found in individual samples. Effects are unknown.



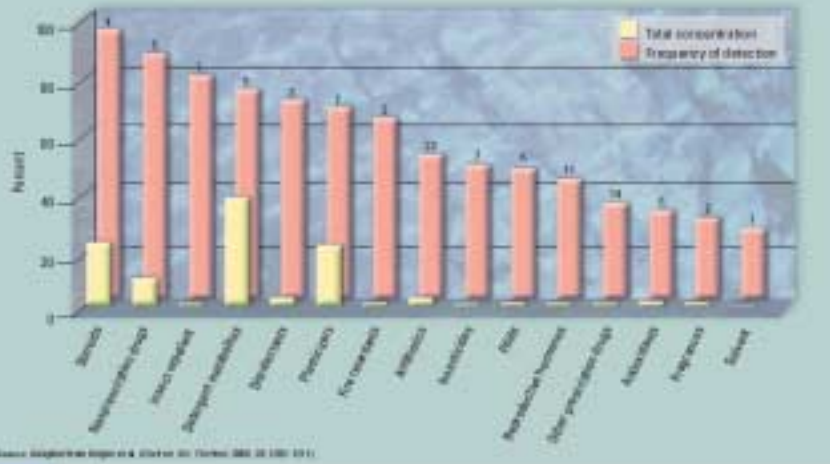
"Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance," Dana W. Kolpin, Edward T. Furlong, Michael T. Meyer, E. Michael Thurman, Steven D. Zaugg, Larry B. Barber, and Herbert T. Buxton, Environ. Sci. Technol. 2002, 36(6):1202 - 1211.



FIGURE 4

Organic wastewater contaminants by general use category

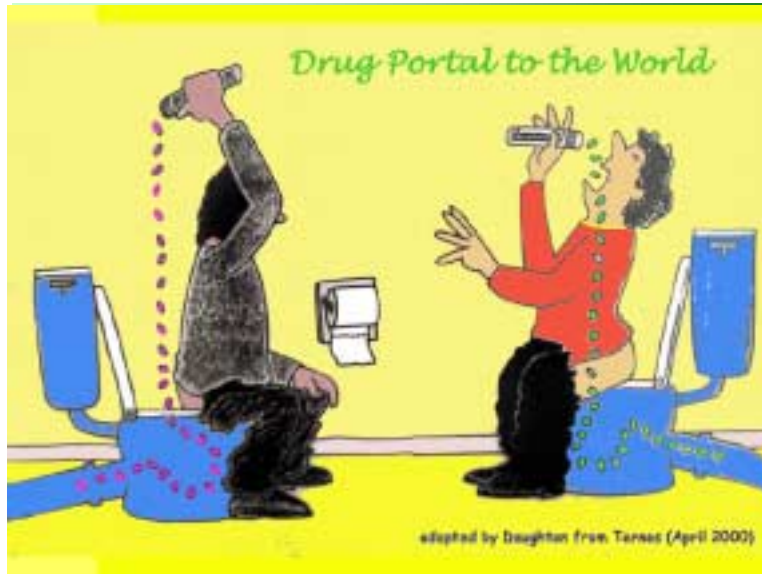
Emerging organic contaminants in U.S. streams, as reported by the U.S. Geological Survey, can be broken down into 15 categories. Orange bars show frequency of detection, and yellow bars show the percent of the total removed concentration. The number of compounds in each category is shown above the orange bars.



Removal of Pharmaceuticals during Drinking Water Treatment

- Concentration of pharmaceuticals in water to be treated depended on the amount of treated wastewater in the source water
- Metabolites of pharmaceuticals are often more polar and pass through wastewater treatment
- Biodegradation and sorption of the pharmaceuticals was insignificant.
- Treatment with ozone and granular activated carbon was effective. Not commonly used in the U.S. Flocculation was not effective at removal.

Thomas A. Ternes et al. Removal of Pharmaceuticals during Drinking Water Treatment. *Environ. Sci. Technol.* 2002, 36, 3855-3863

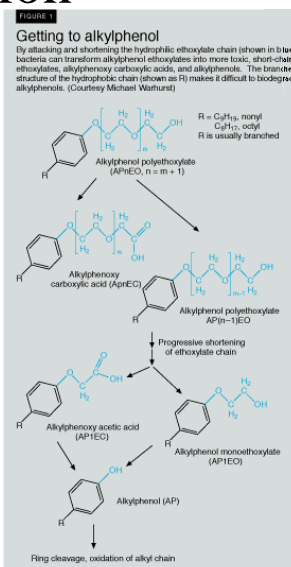


From <http://www.epa.gov/esd/chemistry/pharma/slides/part2.pdf>



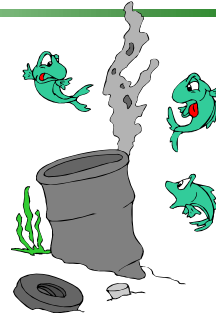
Biodegradation

- % ThOD
 - Nonylphenol = 5 - 10
 - Alkylpolyglycocide = 73 - 88
- Bioaccumulation
 - Contaminants can build up to toxic levels
 - APEs have a BCF > 100





Toxicity



– Aquatic toxicity

– Methods for assessing aquatic toxicity (LC50)

- fish
- algae
- daphnia



PBT

Change in Number of Advisories from 1993 to 1997

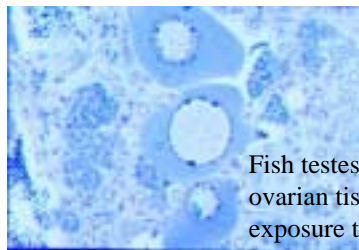
- Persistent
- Bioaccumulative
- Toxic





Endocrine Disruption

- Endocrine Disruption
 - chemicals that mimic or block the activities of hormones
 - APEs

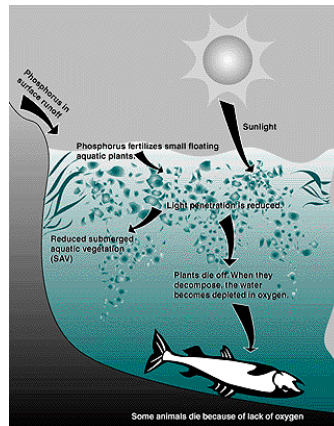


Fish testes containing ovarian tissue due to exposure to ED compounds



Other impacts

- EDTA - mobilizes heavy metals
- Eutrophication
 - nutrient loading





End of Overview

Next: focus on alkyl phenol ethoxylates