Overview of Emerging Contaminant Issues

Environmental Business Council -
New Hampshire Chapter Program:
Contaminants of Emerging Concern

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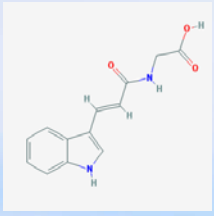
Outline of Presentation

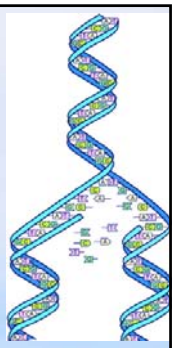


- Background
- Regulations
- Impacts
- Contaminants of emerging concern - moving target
- Need to manage better
- Green chemistry

Emerging Chemicals, Emerging Knowledge

- Emerging contaminants
  - Have only appeared recently
- Contaminants of emerging concern
  - Have been around but concerns raised recently
- Ideally, knowledge should emerge first
  - Prevent release of contaminants

Universe of Chemicals



- ACS Chemical Abstracts Service registrations:
  - Chemicals reported in literature and patents
  - 89 million organic and inorganic substances
  - 65 million genetic sequences
  - Every day, 15,000 chemicals and sequences are added
- Toxic Substances Control Act inventory
  - 85,000 synthetic chemicals in commercial use today
  - Not including:
    - Pesticides
    - Foods and food additives
    - Drugs
    - Cosmetics
    - Tobacco
    - Nuclear materials
    - Munitions
  - Several thousand added each year

Federal Toxic Substances Control Act

- Was enacted in 1976 and has never been overhauled
- The law was broken from the start
  - Puts the burden of proof of harm on EPA
  - EPA can't require testing to see if there is a risk unless it first shows risk is likely
  - Grandfathered the ~62,000 chemicals in use at the time
  - Does not require adequate information on chemicals
  - Fails to address costs of impacts
  - Chemicals can be tweaked
    - Parade of harmful brominated flame retardants
    - Bisphenol S rolled out to replace bisphenol A without even testing it for the same kinds of problems BPA was shown to cause
- Attempts to strengthen TSCA have been defeated
- December 2015 - Senate approved a bill that would give EPA more clout on chemical safety
  - Earlier in 2015 - the House approved a more tepid bill
  - Negotiations and final vote expected in early 2016

Performance Under TSCA

- Only 2,400 chemicals are high production volume chemicals requiring detailed toxicological testing
- In 40 years, EPA has restricted the use of only 5 chemicals:
  - Polychlorinated biphenyls
  - Dioxin
  - Hexavalent chromium
  - Asbestos
  - Chlorofluorocarbons

Performance Under TSCA – cont'd

- Different process for pesticides and drugs
  - Data showing safety must be submitted before they can be sold
- U.S. regulatory frameworks lags behind other countries and regions
  - e.g., EU and Canada
- EPA still struggles with:
  - Neonicitinoids
  - Perchlorate
  - 1,4-dioxane
  - Perfluorinated chemicals
  - Flame retardants
  - Bisphenol A
  - More

State Laws

- In the absence of federal regulation, ~20 states have created their own toxic chemicals programs to police chemical safety
- A confusing patchwork, but better than nothing
- California:
  - The first state to ban certain flame retardants – several states followed
  - Restricts lead and cadmium in jewelry
- Manufacturers generally retool their products to meet state standards that protect consumers nationwide

Human Exposure

- Toxins not on our radar until Rachel Carson's 1962 book about pesticides - *Silent Spring*
  - "For the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death."
- Studies in 2004 and 2009 detected hundreds of industrial chemicals and pesticides in umbilical cord blood, including:
  - Organochlorine pesticides, including DDT and chlordane
  - Bisphenol A
  - Polyaromatic hydrocarbons
  - PFCs
  - Dioxins and furans
  - Flame retardants
  - Polychlorinated naphthalenes
  - PCBs
  - What else was present but not analyzed for?

Environmental Contamination

- Flame retardants in
  - Humans
  - Peanut butter
  - Bacon
  - Salmon
  - Chili
  - Sliced lunch meat
  - Honey from Brazil, Morocco, Spain, and Portugal
  - Antarctic penguins
  - Arctic orca whales
  - North American kestrels and barn owls
  - Bird eggs in Spain
  - Fish in Canada
  - Tree bark samples worldwide
- Bisphenol A in
  - Humans
  - Groundwater
  - Surface water
  - Sediments
  - Soils
  - Plants
  - Animals

Health Effects of Chemical Exposure

- Wide array of health effects, including
  - Asthma
  - Cancer
  - Neurological problems – e.g., ADD
  - Reproductive problems – e.g., infertility
  - Obesity and diabetes
  - Autoimmune disease
- World Health Org. estimates 4.9 million deaths worldwide in 2004 due to chemical exposure
- $177 billion a year in health costs due to endocrine-disrupting chemicals in Europe alone
- $76 billion in children's health costs due to toxic chemicals and pollutants in air, food, water, and soil in U.S. alone

How Do They Emerge?

- Haphazard
- Analytical methods improve – incl. biomonitoring
- Known releases occur and then chemicals are studied
  - e.g. Spill of coal washing solvent 4-methyl-cyclohexane-methanol in the Elk River in West Virginia in 2014
- Unregulated Contaminant Monitoring of drinking water
- Causes of health or environmental effects are investigated
  - Hoosick Falls, NY – a resident's father had worked at the nearby manufacturing plant for 32 years and died of kidney cancer
  - Testing revealed PFOA in the drinking water
  - The village was recently declared a state Superfund site in 2016

CECs – A Moving Target

- Lead may be the first CEC
- Possible CECs now:
  - Glyphosate, pyrethrinoids and neonicitinoid pesticides (to replace organophosphate pesticides)
  - Anti-fouling agents (to replace tributyltins)
  - Pharmaceuticals
  - Personal care product ingredients
  - Fragrances
  - Plasticizers (e,g., bisphenol A, phthalates)
  - Hormones
  - Flame retardants
  - Nanoparticles

CECs continued

- Microbeads
- Water and wastewater treatment byproducts
- Fluorinated compounds
- Chlorinated paraffins
- Siloxanes
- Cyanotoxins – among the first organisms on Earth
- Antibiotic-resistant gene sequences
- Rare earth elements
- Radionuclides
- Hydraulic fracturing chemicals

History Repeats Itself?

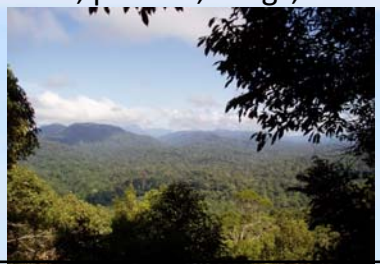
- European cities in medieval times:
  - People threw biological wastes into the streets
  - Rats, fleas, infectious diseases like the bubonic plague
  - People saw the connection
  - Stopped throwing wastes in streets
- Today:
  - We release chemicals into the world
  - Chronic disease
  - People see a connection?
  - Prevent release of harmful chemicals?

Need to Fix TSCA

- Use the precautionary principle – prove chemicals are safe before they can be sold
- Shift burden of proof from EPA to manufacturers
- Give EPA more tools
- Stop grandfathering 62,000 chemicals
- Promote innovation, e.g., green chemistry

Green Chemistry

- Ramped up since Federal Pollution Prevention Act of 1990
- Goal: design chemical products/processes that reduce/eliminate hazardous substances
- Moving away from petrochemicals and halogens
  - Example of innovation: R&D of artificial photosynthesis to capture and convert CO_2 emissions to generate fuels, plastics, drugs, and other products



Green Chemistry - continued

- Presidential Green Chemistry Challenge Award 1996-2014:
  - 1,492 technologies nominated
  - 98 winners have
    - Eliminated 826 million pounds of haz chemicals
    - Saved >21 billion gallons of water
    - Eliminated 8 billion pounds of CO_2 emissions
  - Examples
    - Environmentally safe marine anti-foulant
    - Photographic film that uses heat instead of developer chemicals
    - Detergents that allow CO_2 to be used as a solvent instead of haz chem solvents

Conclusion

- Current approach is unpredictable, reckless, costly
- Knowledge, instead of chemicals, must emerge:
  - About contaminants that are in the environment now
  - To keep new contaminants out of the environment

Thank You

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