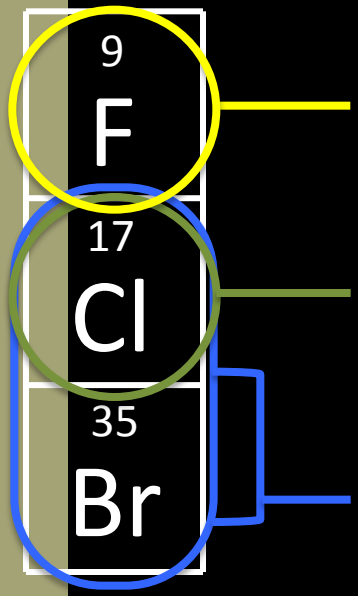
Six classes



1. **Highly fluorinated chemicals**
   water and oil repellants, surfactants…
2. **Antimicrobials**
   triclosan, triclocarban…
3. **Flame retardants**
   brominated, chlorinated, phosphate
4. **Bisphenols and phthalates**
   plastic additives…
5. **Organic solvents**
   benzene, methylene chloride...
6. **Certain metals**
   lead, mercury, chromium, cadmium, arsenic...

Toxics Use Reduction Institute

Organic Solvents

Six Chemical Classes Webinar Series

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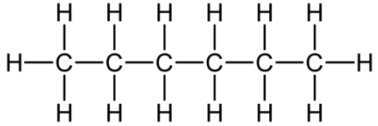
Solvents – basic functions

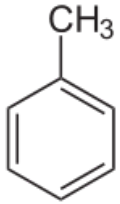
- Dissolve or disperse materials
- Carrier solvents
- Cleaning and stripping
- Mixing medium

Hydrocarbon Solvents

- Aliphatic organic solvents
  - Petroleum distillates, mineral spirits, hexane



- Aromatic organic solvents
  - Toluene, xylene, benzene



- Paints, coatings, thinners

- adhesives, printing inks

Chlorinated Solvents

- Methylene chloride (dichloromethane)
- perchloroethylene (perc)

- Paint strippers

Credit: Making it mine blogspot

- Dry cleaning

Oxygenated Solvents

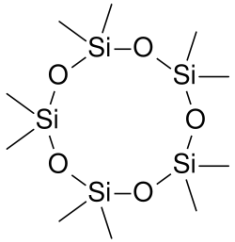
- *Examples:*
  - ethyl acetate
  - Acetone
  - glycol ethers
  - alcohols

- Nail polish and polish remover

- Janitorial cleaners, personal care products

Volatile Methyl Siloxanes: cyclosiloxanes

- *Examples:*
  - D5 cyclic siloxane



  - Dry Cleaning

  - D4 and D5 cyclic siloxanes (cyclomethicone, cyclosiloxanes)

CYCLOPENTASILOXANE

  - cosmetics, hair conditioners, personal care products

Water

Nature’s original solvent

Human Health Concerns

Broad, diverse category with various concerns

- Neurotoxicity – most organic solvents
- Carcinogenicity – Chlorinated/brominated
- Liver and kidney toxicity - many organic solvents
- Reproductive toxicity
  - e.g., ethylene glycol ethers, N methyl pyrrolidone (NMP)
- Contact dermatitis, defatting of skin – many organic solvents

Other Concerns

Broad, diverse category with various concerns

- Environmental Concerns
  - Volatile Organic Compounds (VOCs) contribute to ground level ozone pollution
  - Potential groundwater contamination from spills
  - Persistence – siloxanes, chlorinated solvents
- Safety Concerns
  - Flammability – many organic solvents

Examples of Exposure

Credit: Making it mine blogspot

- Methylene Chloride paint strippers
  - Very volatile, high inhalation exposure
  - High vapor density – vapor “sinks”
  - Worker deaths from bathtub refinishing

- Cyclosiloxanes
  - Volatile, inhalation exposure
  - Used widely in personal care products and found throughout the environment
  - Health and environmental concerns

Siloxanes - Current activity and concerns

There's no such place as "away"

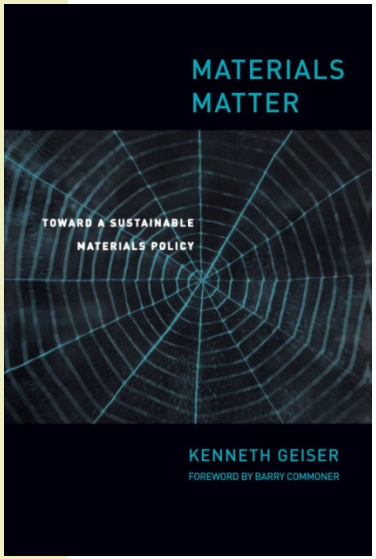
- Cyclic Siloxanes – D4, D5, D6
  - EPA negotiating exposure monitoring agreement with industry. Risk Assessment is planned.
  - Biomonitoring California
- D5: Canadian Siloxane D5 Board of Review
  - concluded that although persistent, unlikely to cause environmental effects
- D4: - Canada requires pollution prevention planning
  - EU Determination of Persistent, Bioaccumulative and Toxic

Solutions? Safer Alternatives

- Paints and coatings: water-based products
- Paint strippers: dibasic esters
- Garment dry cleaning: wet cleaning
- Ethylene based glycol ethers: propylene based glycol ethers

Take Away Points for Solvents

- Diverse set of substances
- Many known health, environmental and safety concerns
  - Neurotoxicity, flammability, Liver and kidney toxicity, respiratory, eye and skin irritants
- Some emerging concerns or questions
  - E.g., cyclosiloxanes
- Safer alternatives available
- Move forward using Green Chemistry



Book recommendation:
Materials Matter
By Dr. Kenneth Geiser

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"The products we purchase and use are assembled from a wide range of naturally occurring and manufactured materials. But too often we create hazards for the ecosystem and human health as we mine, process, distribute, use and dispose of these materials… This book argues that the safest and least costly point at which to avoid environmental damage is when materials are first designed and selected for use…"