# Chronic Disease: Introductory Concepts

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# Outline

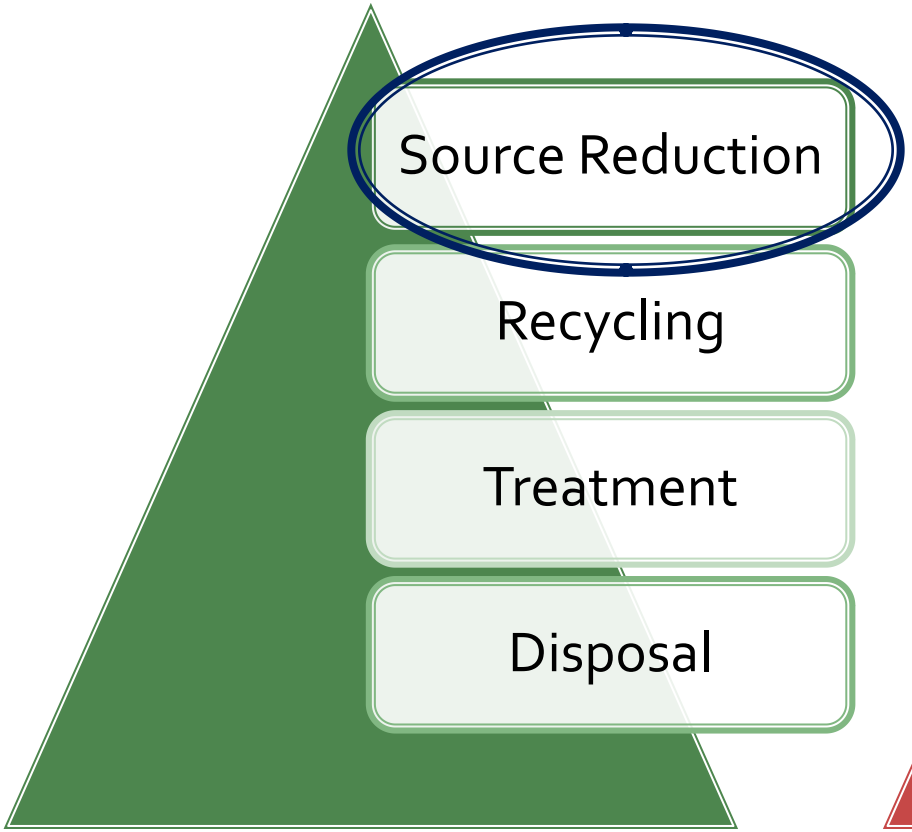
- Primer on Important Chronic Disease Concepts
  - Primary Prevention:  Familiar Territory to TUR Planners
  - Mechanisms of Disease Causation: 2 Useful Metaphors
  - Critical Windows of Development/Timing of Exposure
  - Low Dose Effects
  - Disease Latency

# Primary, Secondary & Tertiary Prevention

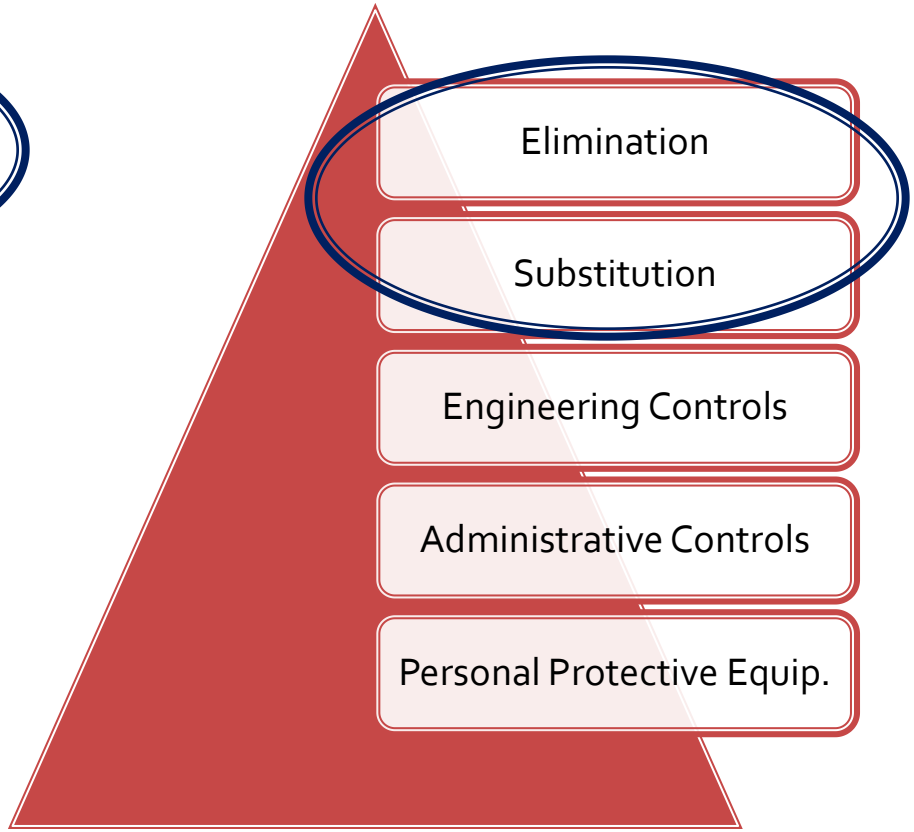
- Primary Prevention: Interventions that keep diseases from ever developing in the first place
- Secondary Prevention: Interventions to diagnose and treat early stages of a disease before it causes significant morbidity
- Tertiary Prevention: Interventions to reduce the negative impact of disease by restoring function and reducing disease-related complications

# Toxics Use Reduction: A Crucial Primary Prevention Strategy

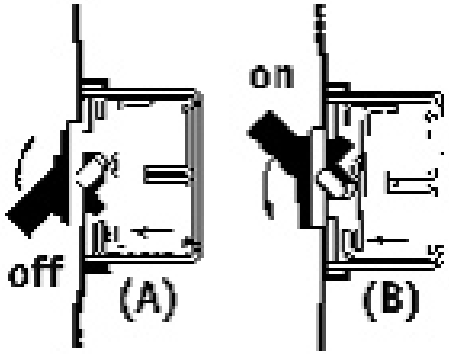
**POLLUTION PREVENTION HIERARCHY**

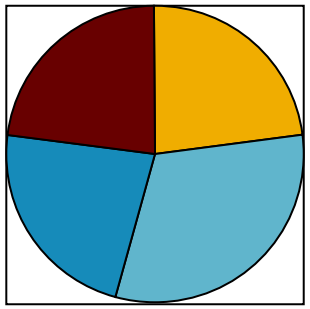


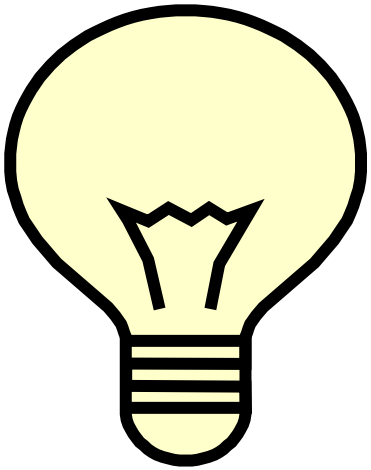

**INDUSTRIAL HYGIENE HIERARCHY**



# Chronic Disease: A Multi-Factorial, Multi-Stage Process





# Disease Causation: Critical Windows of Development/Timing of Exposure

- Examples from cancer studies
  1. Woburn MA: Childhood leukemia 8.3 times higher among children whose mothers drank contaminated water while pregnant.
  2. Girls exposed to DDT before puberty were 5 times more likely to develop breast cancer when they reach middle age
  3. Cancer risk among workers exposed to radiation is greater among older workers than younger worker *when exposed to the same* dose.

(1) References: Sci Total Environ. 2002 Dec 2;300(1-3):23-35; (2) Environ Health Perspect. 2007 Oct;115(10):1406-14. Am J Ind Med. 1993 Mar;23(3):371-89; Int J Epidemiol. 1999 ; (3) Jun;28(3):428-36.

# Low Dose Effects

- "Low dose": doses below those tested in traditional toxicological assessments
- Primary mechanism: endocrine disruption by mimicking the action of hormones.
  - Small changes in hormone concentration can have biologically important consequences.

| Chemical | Endpoint affected at low doses |
|---|---|
| BPA | Prostate and mammary gland, brain development and behavior, reproduction, immune system, metabolism |
| Dioxin (TCDD) | Spermatogenesis, immune function and oxidative stress, tooth and bone development, female reproduction, mammary gland, behavior |
| Perchlorate | Thyroid stimulating hormone levels |

Reference: Endocr Rev. 2012 Jun;33(3):378-455

# Disease Latency

- Disease latency: "The time interval between disease occurrence and its subsequent detection.*"
  - Important for studying disease-exposure connection
  - Cancer: long latency
    - In adults: Exposure to causal agents likely occurred 10-30 years (depends on the type of cancer) prior to diagnosis. Children: latency 0-10 years
  - Sensitizing asthma: shorter latency
    - 1st exposure does not cause disease. Requires sensitizing period.

*Reference: Rothman. *Epidemiology: An Introduction.* New York, NY: Oxford Univ Press. 2002