A hand holding a small green seedling in soil against a bokeh background.

# How Part 201 Cleanup Criteria Are Calculated

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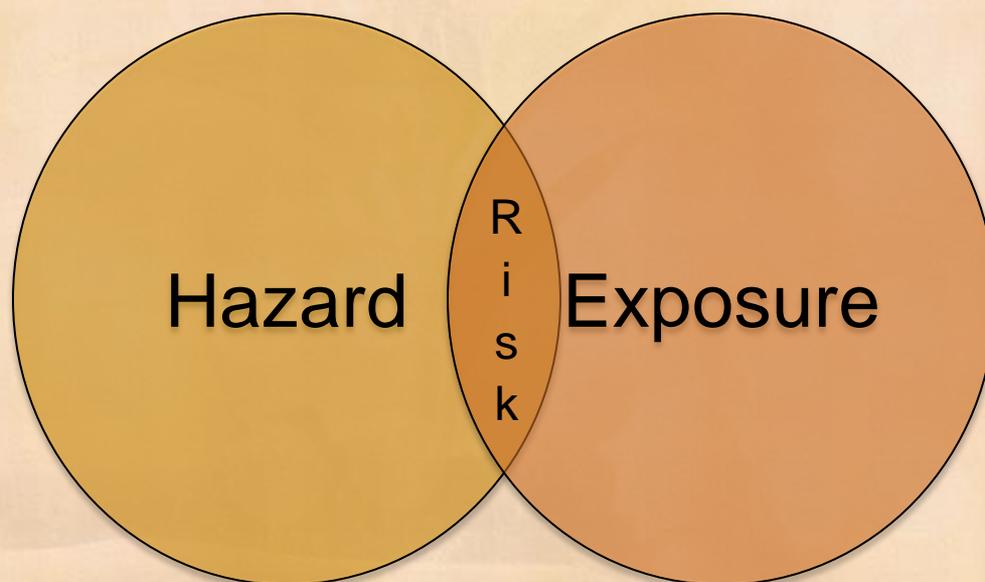
# Risk Characterization



Hazard

Exposure

# Risk Characterization

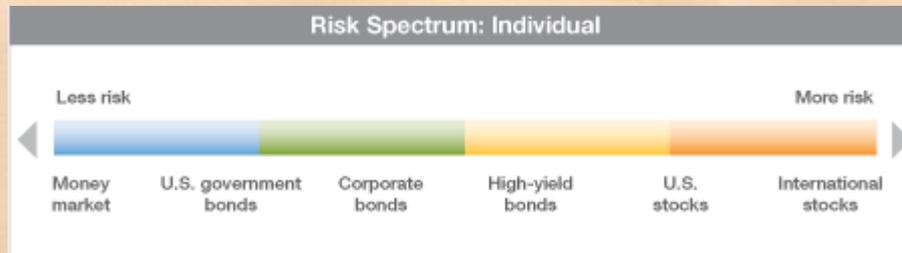


# Risk

“Risk is the probability that a substance will produce harm under specified conditions.”

(Casarett and Doull's Toxicology: The Basic Science of Poisons. Fourth Edition, 1991)

Do you let the conditions define the risk or the risk define the conditions?

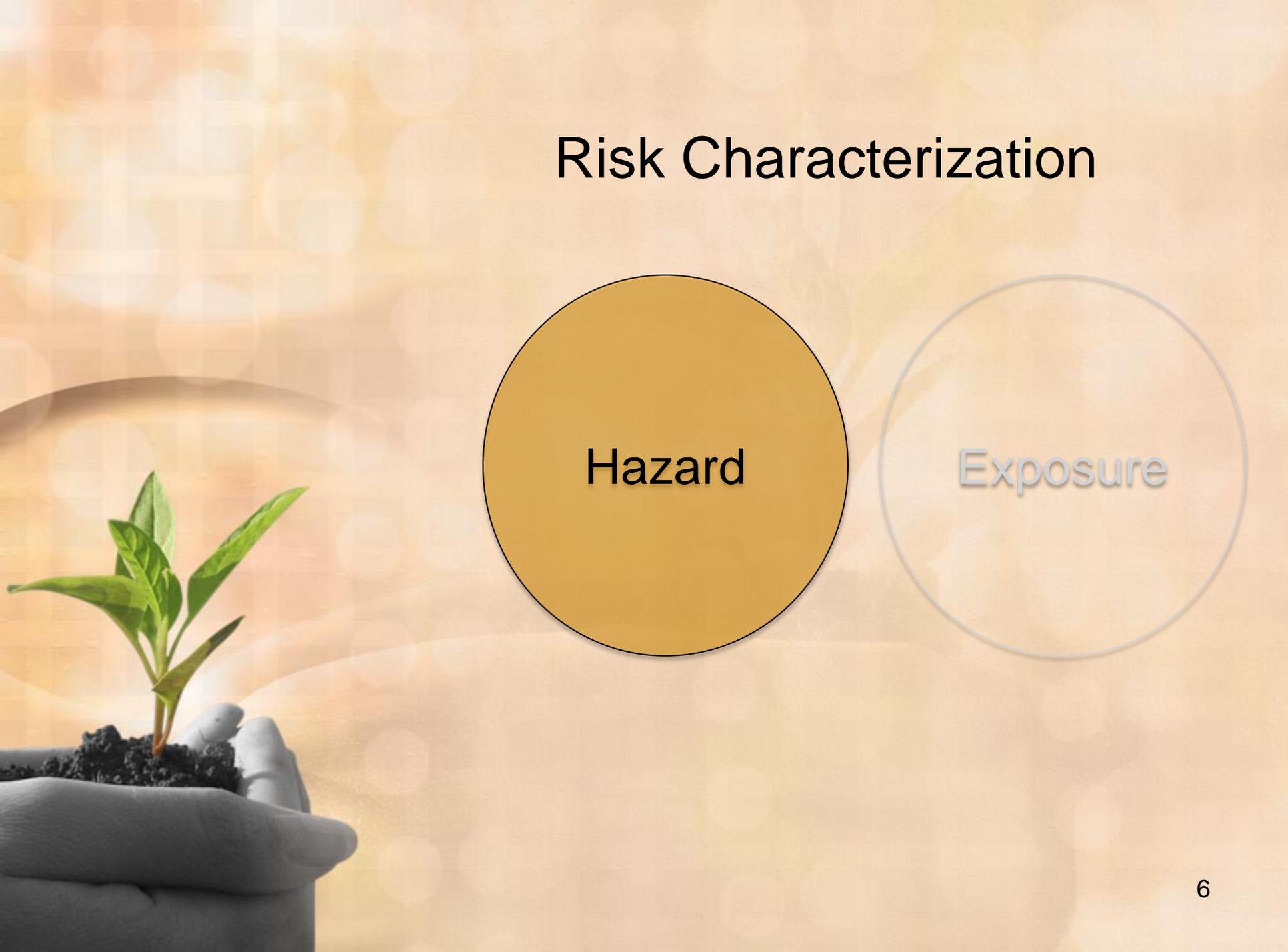


# Risk

- For Part 201 generic cleanup criteria, risk levels are defined in 20120a(4):
  - Carcinogens: 1 additional cancer above the background cancer rate per 100,000 individuals
    - e.g., lymphoma in MI 13.5 per 100,000
  - Non-carcinogens: a hazard quotient of 1.0

$$\text{HQ} = \frac{\text{Estimated exposure level}}{\text{No adverse effect level}}$$

# Risk Characterization



Hazard

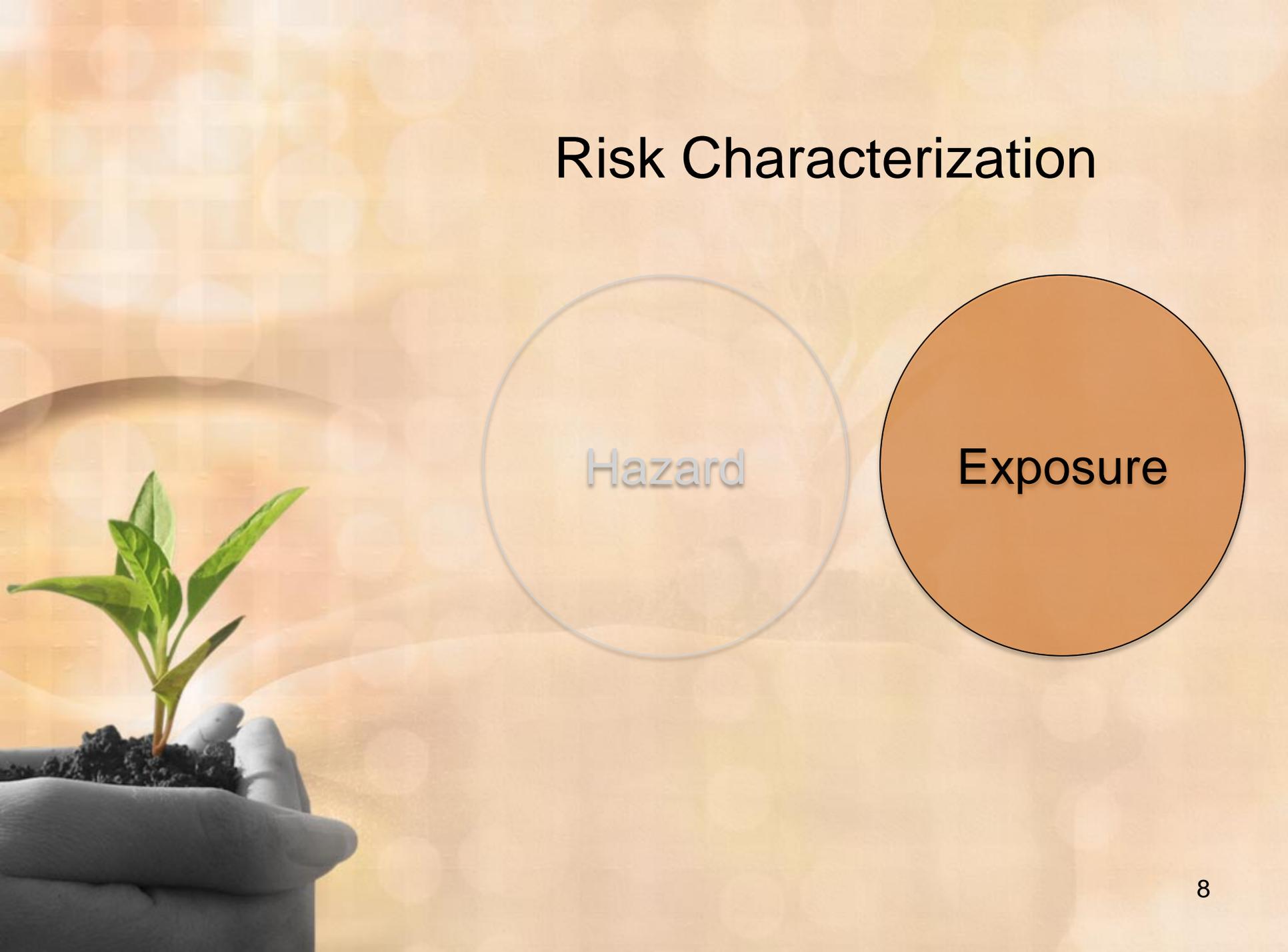
Exposure

# Toxicity (= Hazard)

- Adverse effects of chemical and physical agents on living organisms.
- Dose-response relationship
- Part 201 Cleanup Criteria
  - Carcinogenic effects
  - Non-carcinogenic effects
    - Developmental
    - Reproductive
    - Neurological
    - Endocrine disruption
    - Immunological
    - Systemic



# Risk Characterization



Hazard

Exposure

# Exposure

- Generic Part 201 cleanup criteria
  - Assumptions (defining the conditions)
    - Exposure scenario
    - Population-based
    - Behavior of the exposed population
    - Behavior of the hazardous substance
    - Chemical properties
- Site-specific cleanup criteria
  - Requires collection of more field data
  - More accurately represents site conditions

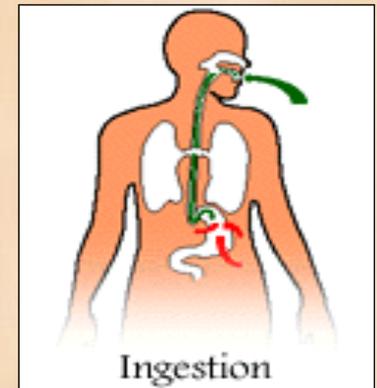
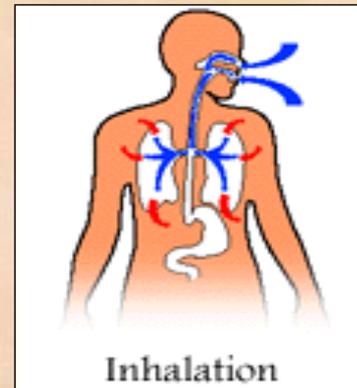
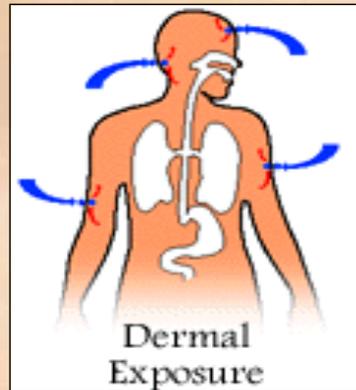


# Exposure



How does the hazardous substance reach the living organism?

# Exposure



How does the living organism come into contact with the hazardous substance?

# Exposure



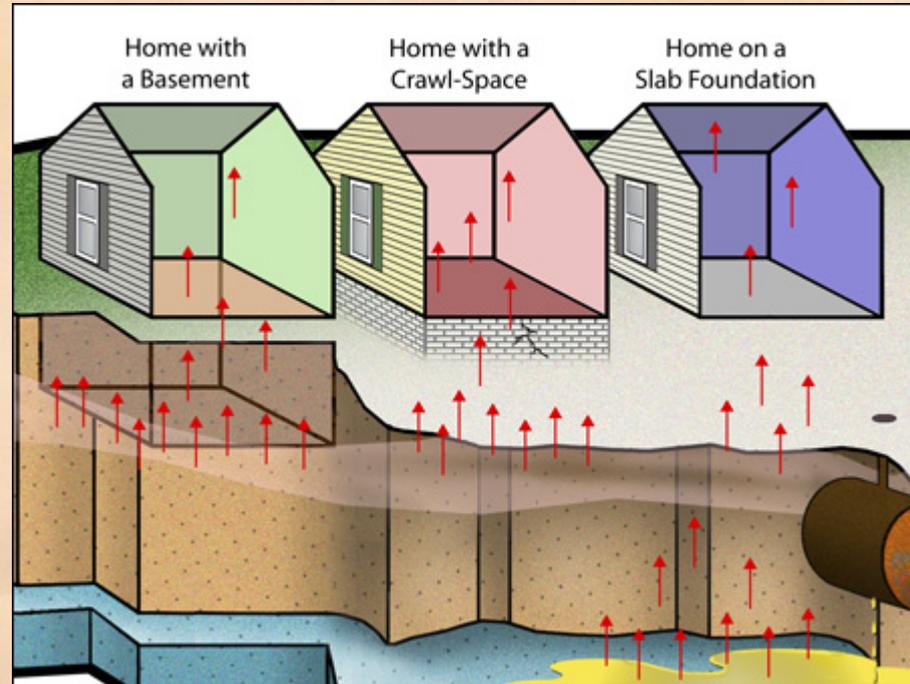
How much of the hazardous substance does the living organism come into contact with?

# Exposure



How often and for how long is the living organism exposed to the hazardous substance?

# Exposure



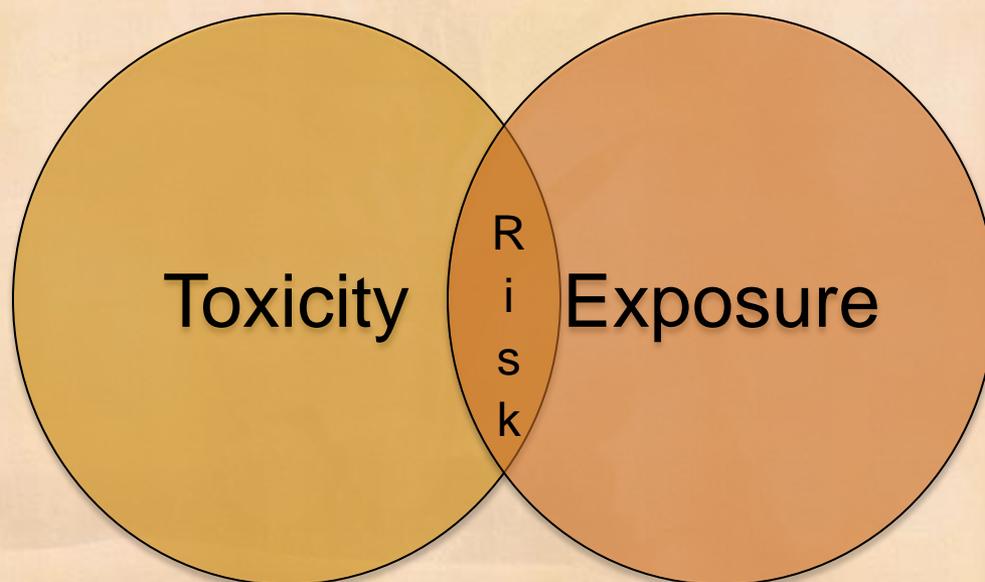
How does the hazardous substance behave in the environment?

# Exposure



How much of the hazardous substance can remain in the environment without causing adverse effects in living organisms?

# Cleanup Criteria



$$\text{Toxicity} \times \text{Exposure} \times \text{Risk} = \text{Criteria}$$

# Part 201 Cleanup Criteria

- Generic Cleanup Criteria
  - Part 201 Statute 20120a (12/2012)
  - Part 201 Rules 299.01 - 299.50 (12/2013)
- Site-specific Cleanup Criteria
  - Part 201 Statute 20120b (12/2012)

