Module Three

Introduction to Risk Assessment

Objectives

Upon completion of this module, you will be able to:

- Define and understand the concept of risk
- Identify and discuss the steps involved in performing a risk assessment
- Understand the roles of risk assessment and risk management
- **Understand the role of ATSDR's public health assessment**

What is Risk Assessment?

- Gathering of information on toxic effects of a chemical
- Evaluation of information to determine possible risks associated with exposure

Risk Assessment Process

1. Hazard Identification

2. Hazard Evaluation or Dose-Response Assessment

3. Exposure Assessment

4. Risk Characterization

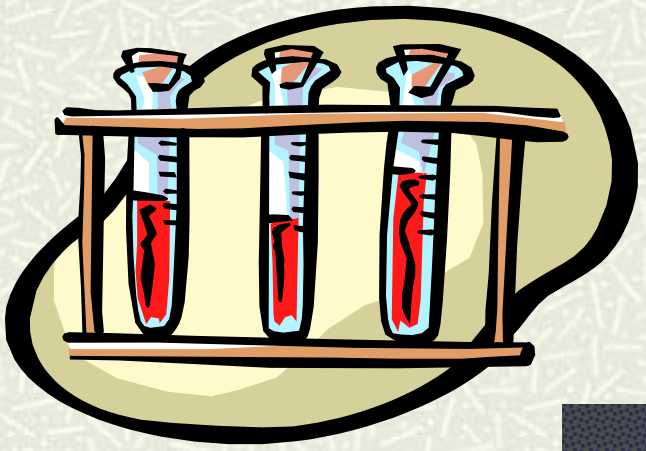
Hazard Identification

- Collection of data
  - Various sources
  - Toxicological and epidemiological studies

- Information should answer these questions:
  - Does exposure to the substance produce any adverse effects?
  - If yes, what are the circumstances associated with the exposure?

Hazard Identification (continued)

- Name of Substance
- Physical/Chemical properties of substance
- Source of the toxicity information
  - Epidemiological Studies
  - Toxicological Studies



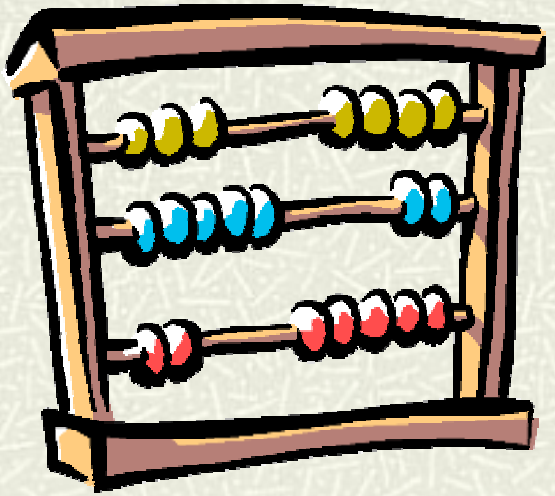
Hazard Identification (continued)

- Exposure to toxic substances
  1. Route
  2. Duration
  3. Frequency

- Other Factors which may affect results
  1. Diet
  2. Lifestyle choices
  3. Occupation

Hazard Evaluation or Dose-Response Assessment

- Purpose of evaluation
  - Calculate the dose-effect
  - Include “safety factor”



- Purpose of assessment

  Determine what dose causes a response

Exposure Assessment

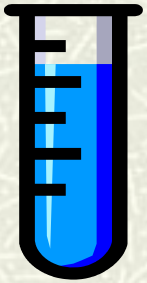
Exposure means contact at a boundary between a human and the environment at a specific contaminant for a specified period of time.

- Exposure Assessment
  - Identifies affected population
  - Calculates the amount, frequency, length of time, and route of exposure

Exposure Assessment (continued)

- Outline
  - General Information for Each Chemical
  - Sources

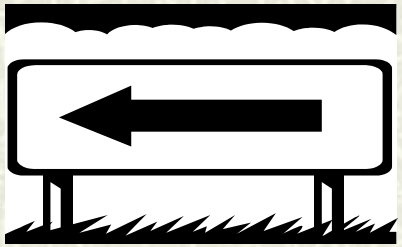
  - Exposure Pathways and Environmental Fate
  - Measured or Estimated Concentrations



Exposure Assessment General Information

- Physical/chemical properties
  - How it is transported
  - How it is accumulated in the environment and in tissue
  - How it is transformed when it is released

These facts determine the dose and route of exposure



Exposure Assessment
Sources of Exposure

Exposure can occur

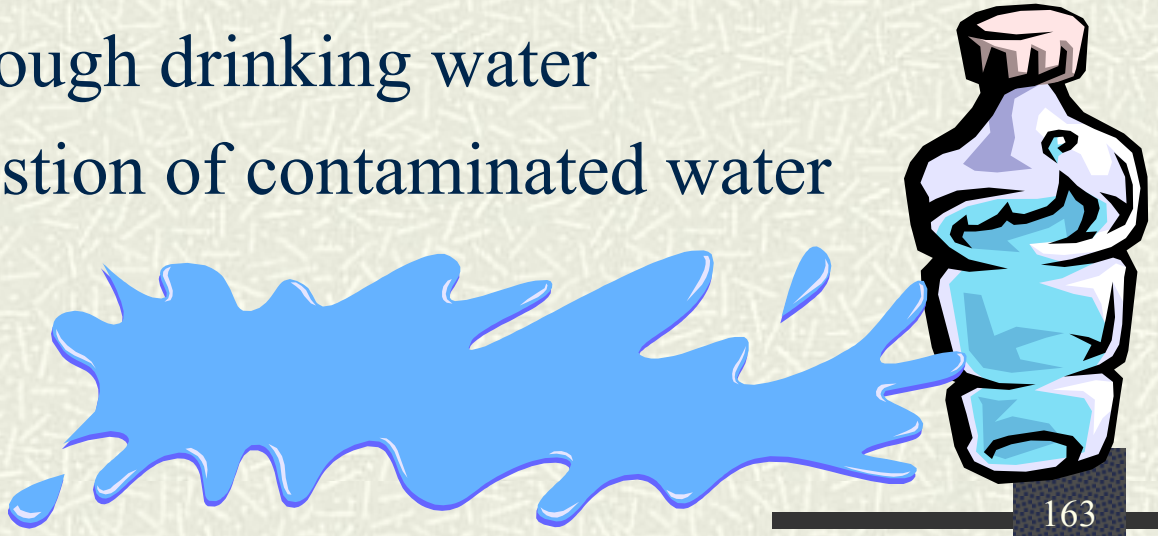
- Inside the home (cleaning products, paints, pesticides)
- Outside the home (pollutants in air)

Exposure Assessment
Exposure Pathways and Environmental Fate

- After source identification, route and nature of the exposure have to be determined.

Example:

- Exposure through drinking water
- Route is ingestion of contaminated water



Exposure Assessment Measured or Estimated Concentrations

- Measured concentrations are obtained from actual samples of the source of exposure
- Estimated concentrations are used when samples are not available, and are based on a mathematical model

Exposure Assessment Measurement of Exposure

- Questionnaires/surveys
- Employment records
- Evaluation of environmental contamination data

Approaches for Assessing Total Exposure

- Indirect Methods
  - Environmental monitoring
  - Fate and transport (migration) computer models
  - Resident questionnaires/surveys
- Direct Methods
  - Personal workplace monitoring
  - Biologic markers

Exposure Assessment

- Assessing Health Disparities by
  - Determining the proximity of communities to waste or industrial facilities
  - Characterizing the nature and extent of exposures
  - Identifying susceptible popula

Factors Which Influence the Extent of Exposure

- Size of population
- Proximity of the community to source of contamination
- Degree of personal contact with site
- Extent of release of substances

Other Characteristics to Include in Exposure Assessments

- Possible health effects from exposure to simple and complex mixtures
- Health impact on susceptible populations

- Geographic area

Identification of Exposed Populations

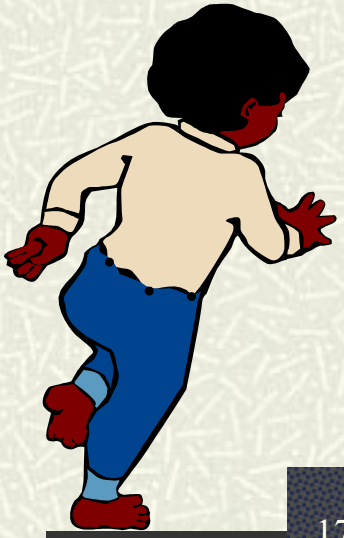
Identify and characterize

- Sex
- Age
- Number of children
- Number of pregnant women
- Number of chronically ill individuals
- Number of individuals with higher risks
- Personal habits

Children's Susceptibility to Exposure

Primary Routes of Exposure

- Ingestion
- Play Activities
- Inhalation
  - Breathing rates



Recurrent Problems in Exposure Assessment

- Absence of actual data
- Lack of personal monitoring
- Inaccurate exposure assessment
- Lack of documentation indicating exposure amount and dose

Recurrent Problems in Exposure Assessment (continued)

- Determining Causal Relationships
  - Exposure and health outcomes
  - Disparities in health status

- Lack of published research
  - Inconsistent data related to exposure and health

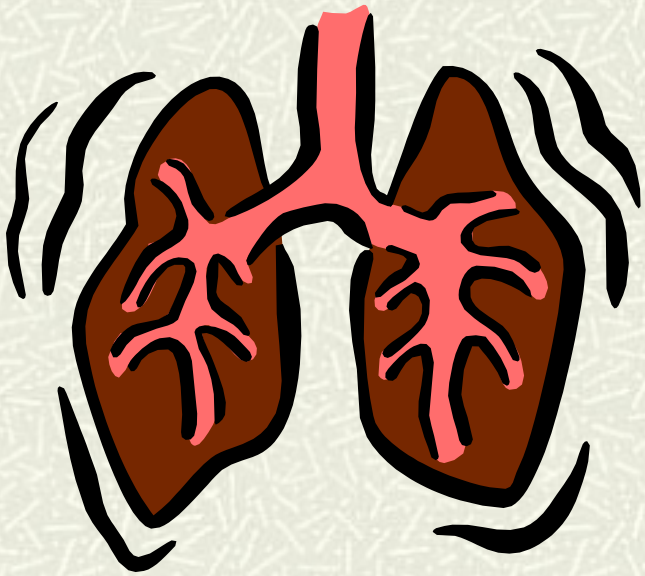
Recurrent Problems in Exposure Assessment (continued)

Limited use of epidemiological methods

- Association of low level exposure and disease
- Studies of adverse effects
- Differentiation of populations

Information Available for Risk Assessments

- Occupational exposure
  - Lung Disease
    - dusts
    - silica dusts
    - coal
  - Lung Toxicity
    - heavy metals
    - carcinogens
  - Neurotoxic Effects



Additional Components of the Risk Assessment

- Calculation of Exposure
- Risk Characterization

Risk Management

- Determines the best approach to address an exposure issue
- Evaluates data from risk assessment
- Evaluates other issues

Question and Answer Period