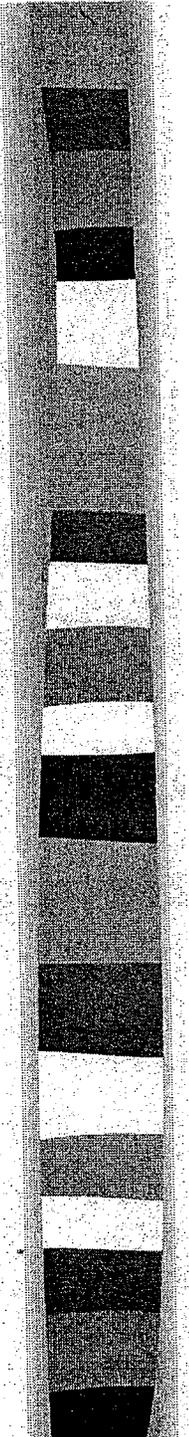


NAVAL AIR STATION ALAMEDA

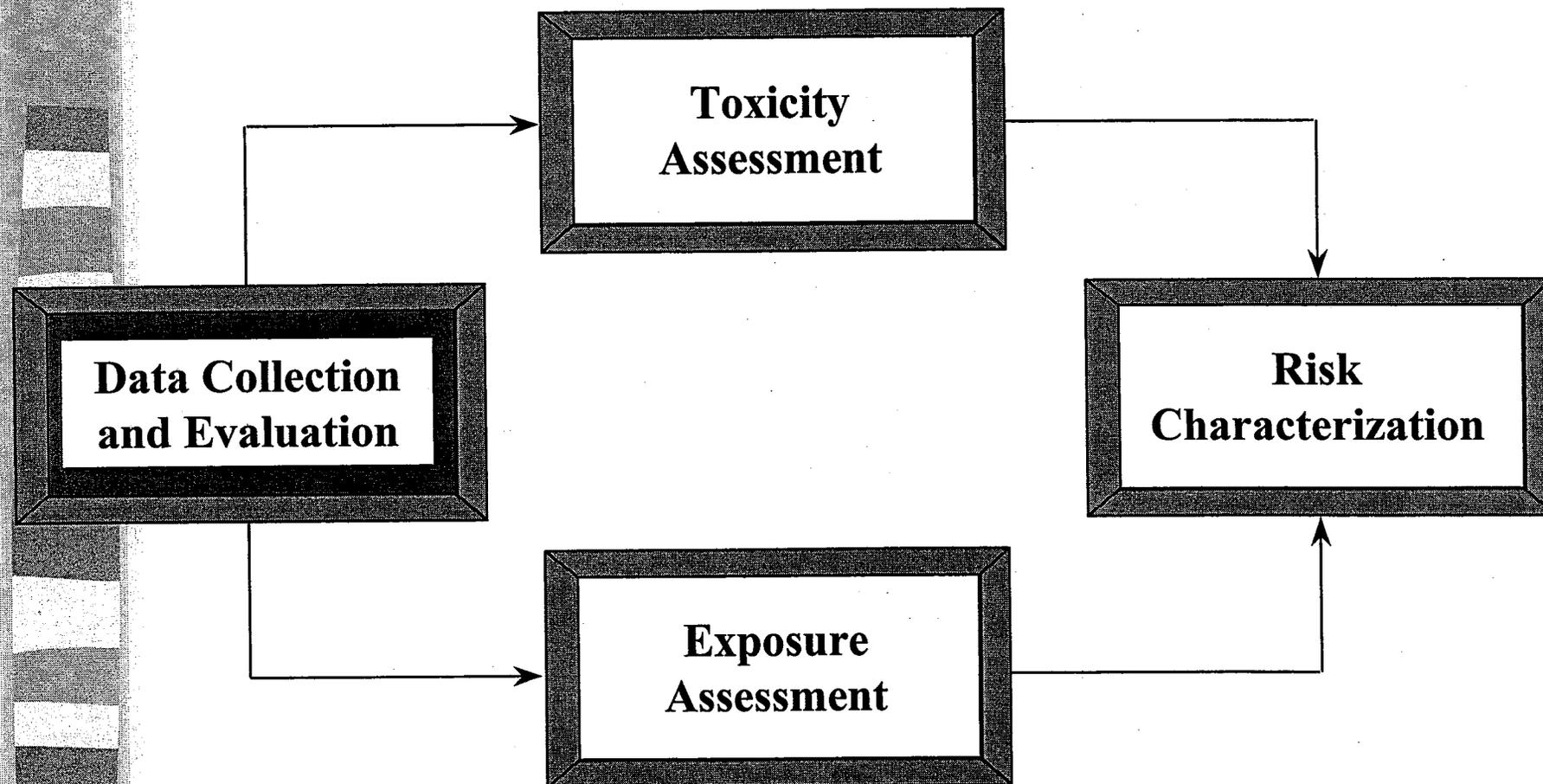
- **MICHAEL J. WADE, Ph.D., DABT
SENIOR TOXICOLOGIST**
- **DEPARTMENT OF TOXIC
SUBSTANCES CONTROL
SACRAMENTO**



OBJECTIVES

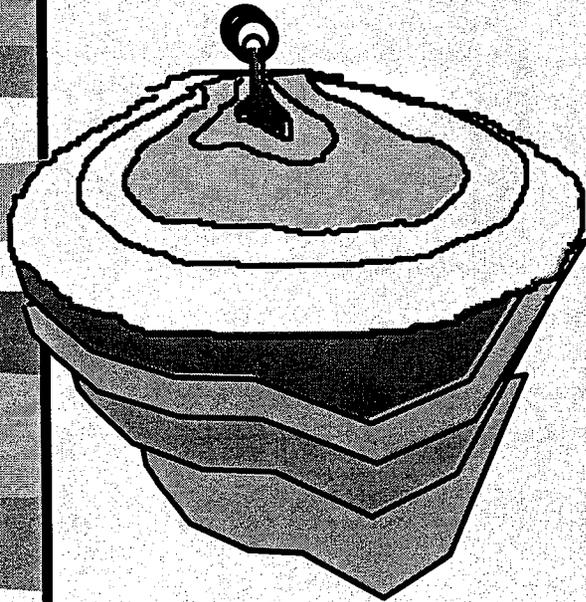
- **OVERVIEW OF RISK ASSESSMENT**
- **BASELINE RISK ASSESSMENT**
 - **HUMAN HEALTH**
- **SCREENING CONTAMINATED SITES**
- **ANSWER YOUR QUESTIONS**

Four Steps of Risk Assessment:



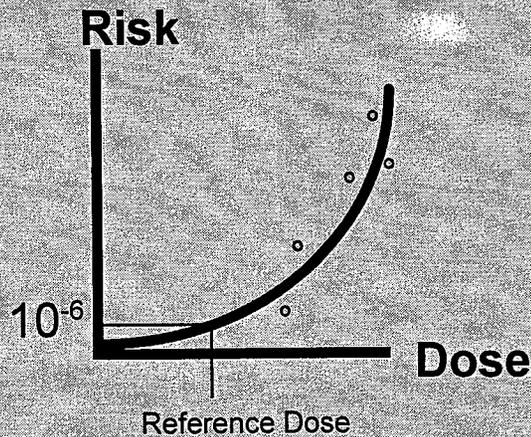
Risk Assessment: Simple Conceptual Components

Source Assessment



Data Evaluation

Toxicity Assessment

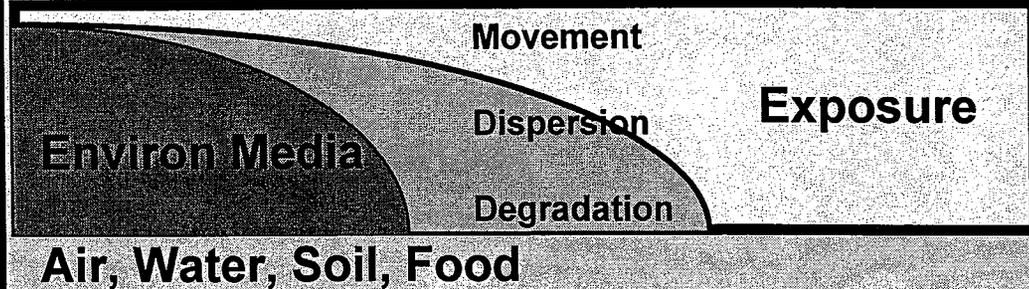


Risk
Characterization

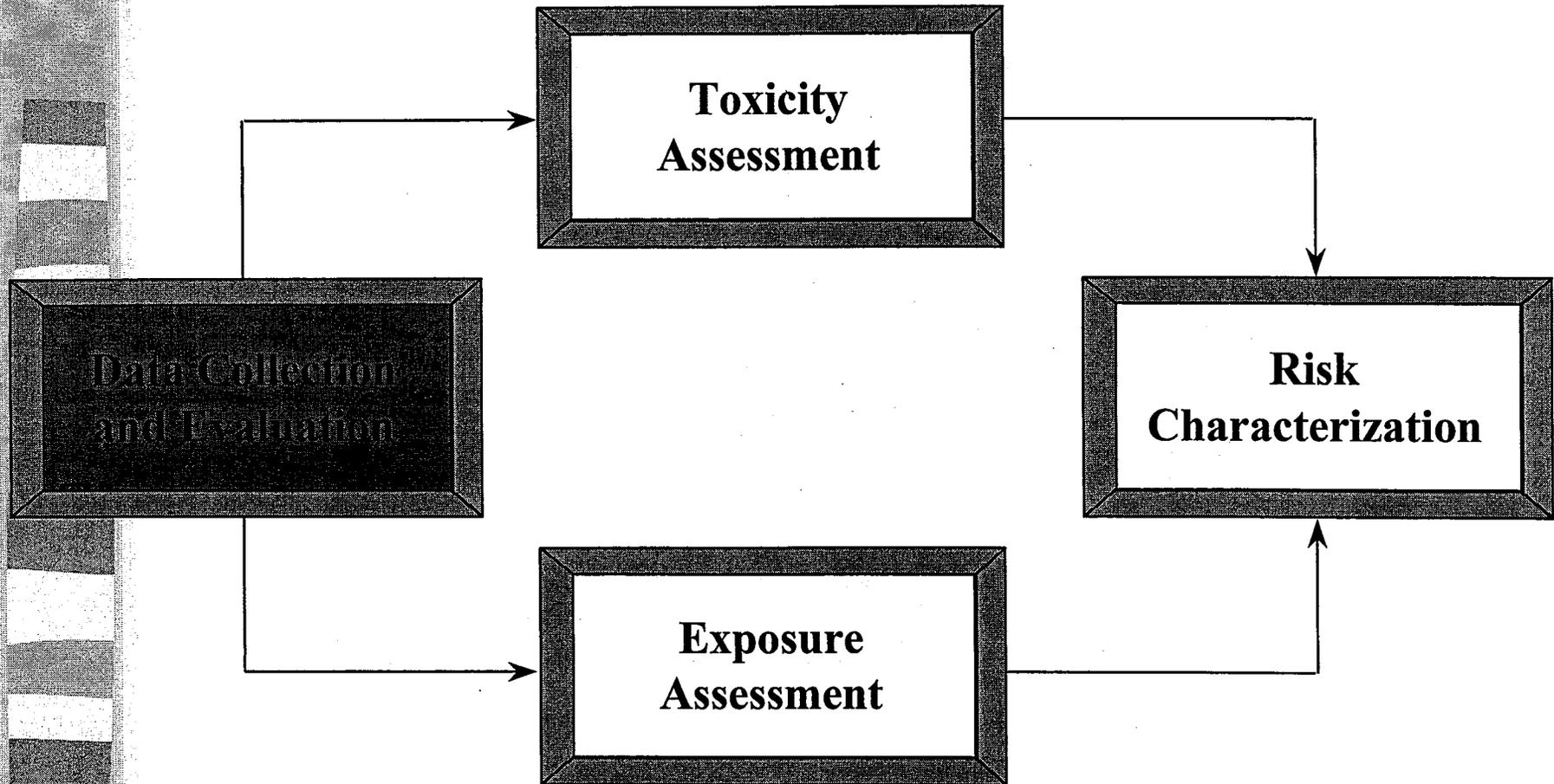
Calculated Risk

Acceptable Risk

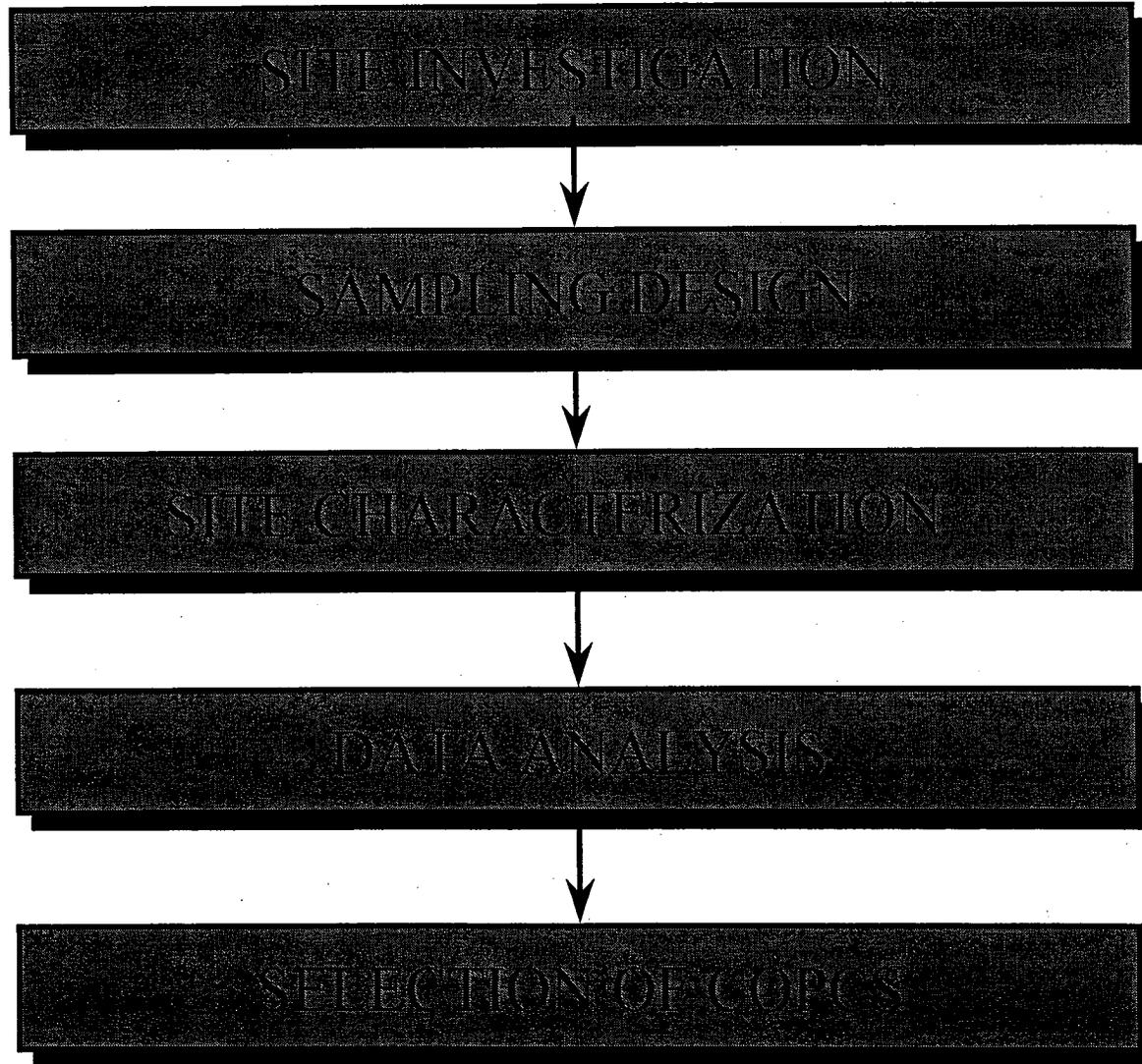
Exposure Assessment

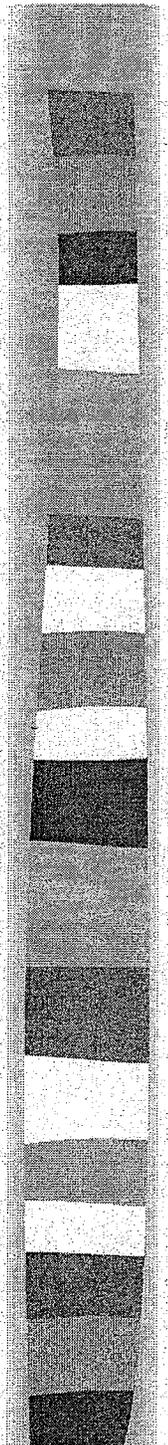


Four Steps of Risk Assessment: Data Collection and Evaluation



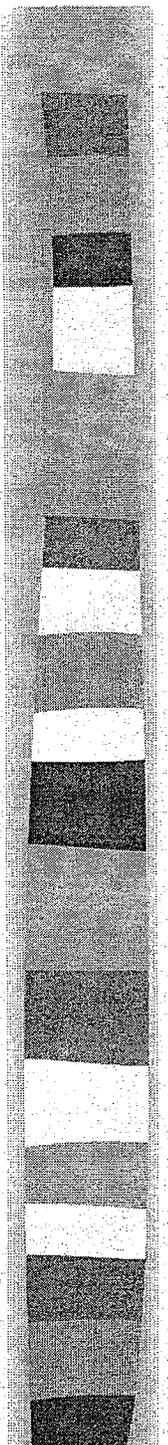
Step 1: Data Collection and Evaluation





SITE CHARACTERIZATION

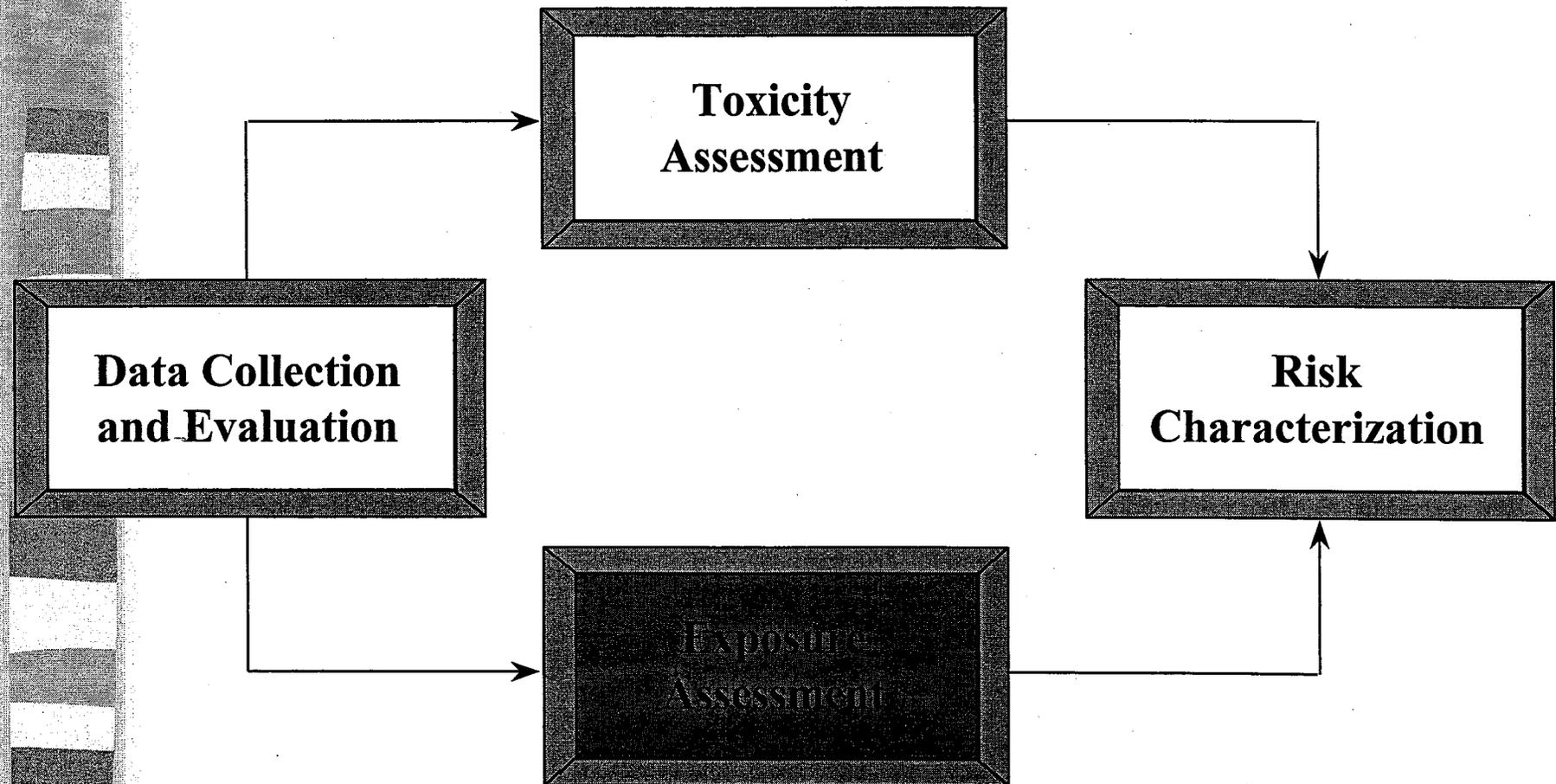
- Sampling: soil, groundwater, sediment, surface water, soil gas, air, biota -

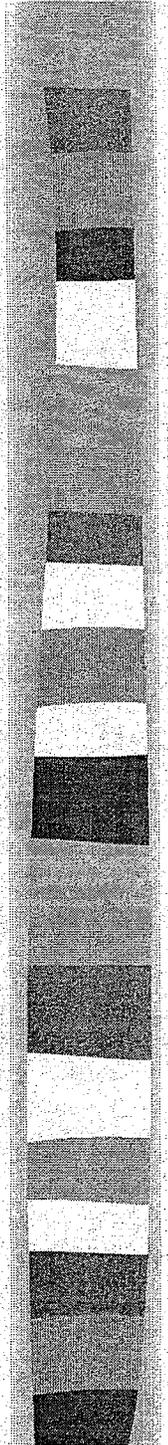


CHEMICAL CONTAMINANTS

- **METALS**
- **VOLATILE ORGANIC CHEMICALS**
(chlorinated solvents, fuel components)
- **POLYNUCLEAR AROMATIC HYDROCARBONS**
- **PCBs**
- **PESTICIDES**

Four Steps of Risk Assessment: Exposure Assessment





EXPOSURE PATHWAYS

- **Incidental soil ingestion**
- **Inhalation of fugitive dust**
- **Dermal contact with soil and/or water**
- **Inhalation of vapors from soil or groundwater**
- **Ingestion of groundwater or surface water**

What Is an Exposure Route?

- Gases
- Airborne dust

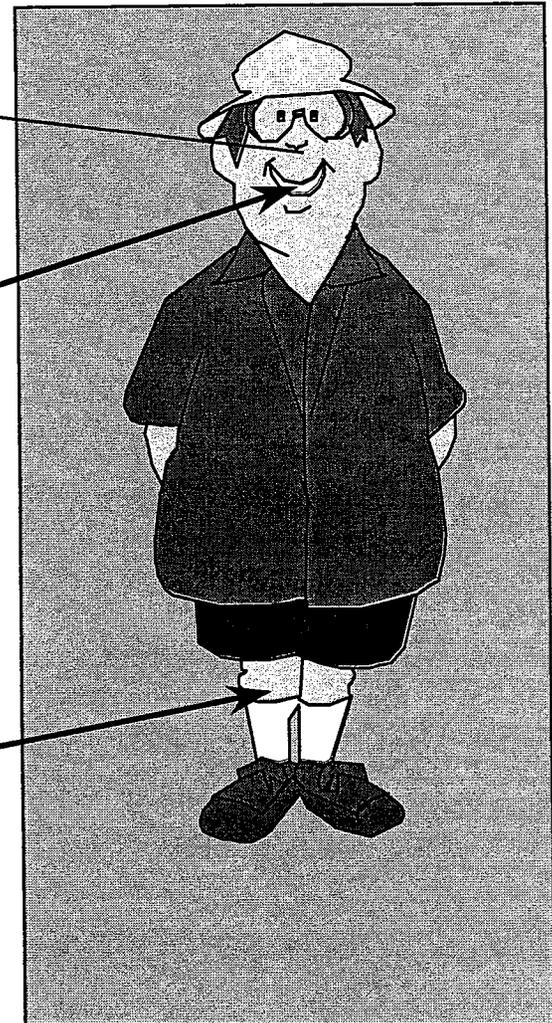
Inhalation

- Soil
- Water
- Food

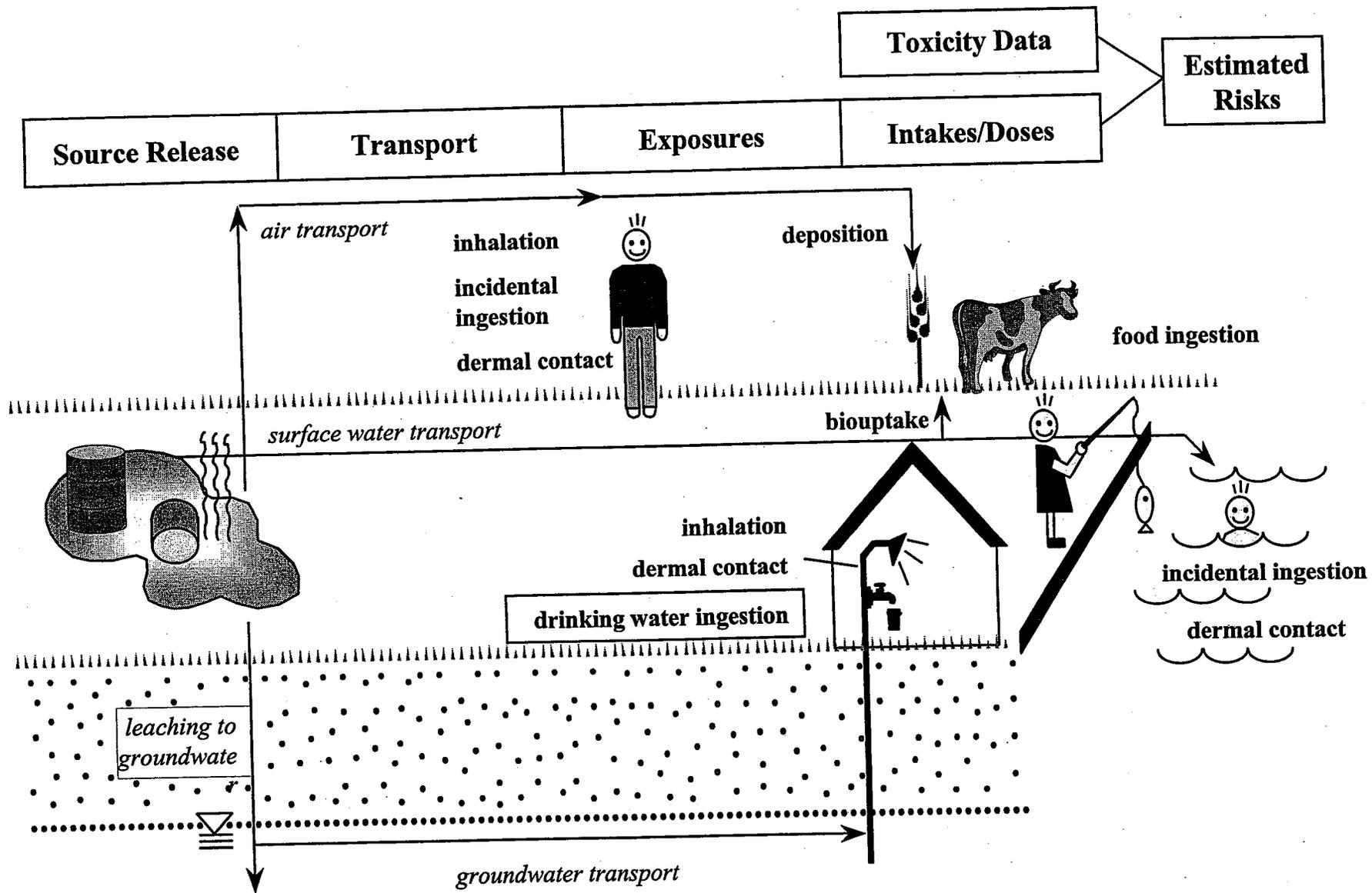
Ingestion

- Soil
- Water

Dermal Contact



Many Exposures Can Contribute to Estimated Risks



O' what a tangled web we weave..

Biosphere

Air

(1) Monitoring Data

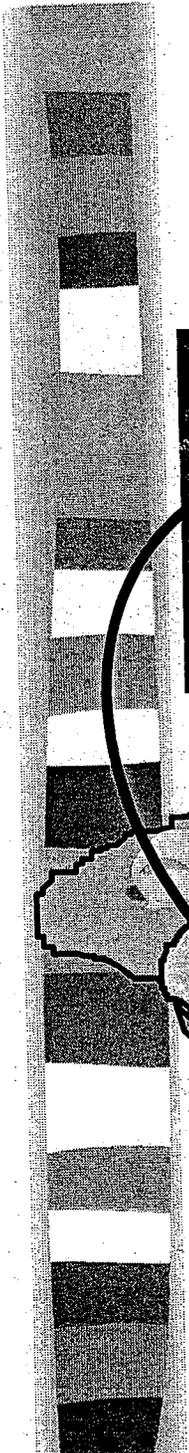
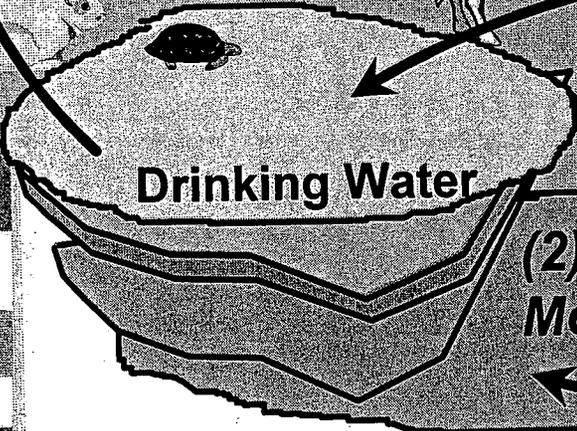
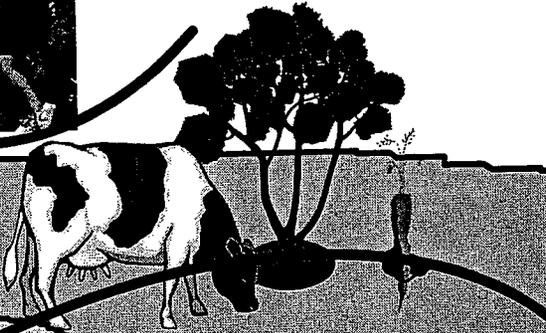
Food Chain

(3) Exposure Assumptions

Drinking Water

(2) Environmental Models

Geosphere



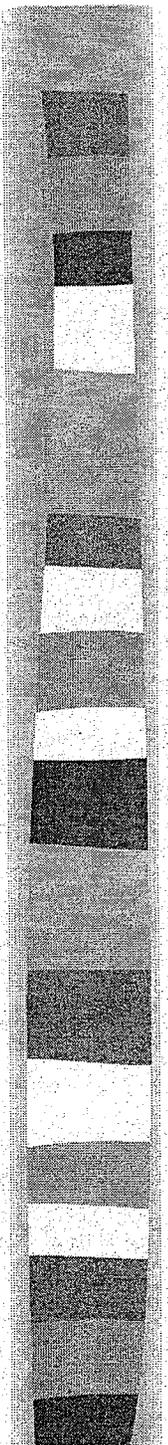
How Do We Calculate Chemical Intake?

Concentration in
soil, water, or air

X

Exposure Parameters:
Specific to the receptor
and exposure scenario

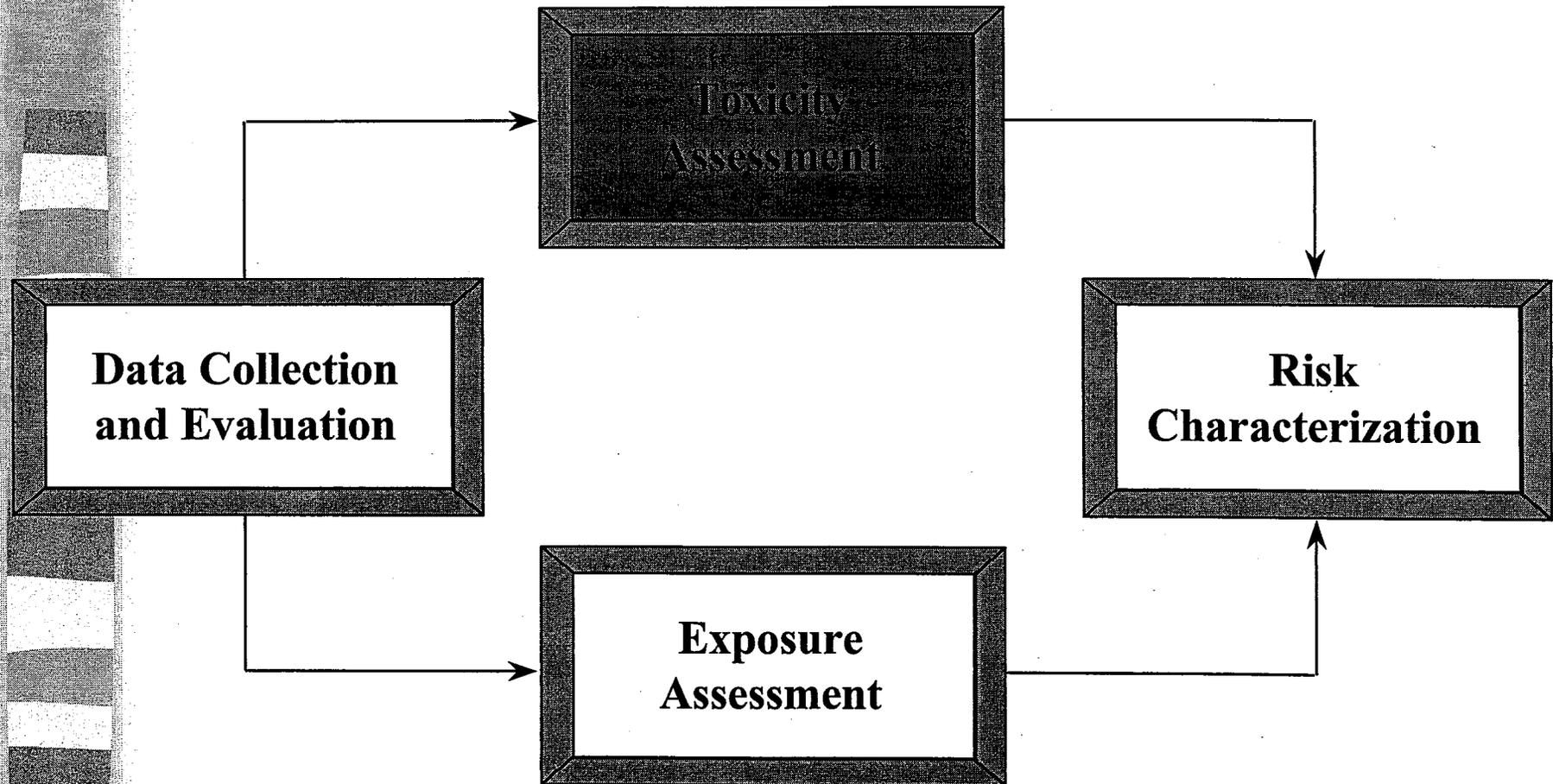
$$\text{Intake} = \frac{\text{Chemical Concentration} \times \text{Intake Rate} \times \text{Exposure Frequency} \times \text{Exposure Duration}}{\text{Body Weight} \times \text{Averaging Time}}$$

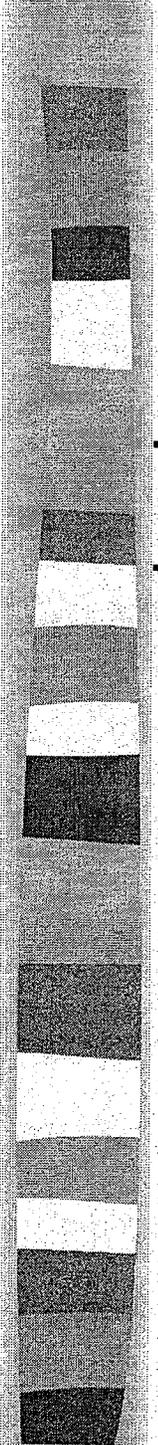


ESTIMATING EXPOSURE

- Exposure parameters
- $E_{z(dw)} = C_{z(dw)} \times 2 \text{ Liters/day}$
- Sum exposure for all media and pathways
- $\sum_z \text{soil}, \sum_z \text{water}, \sum_z \text{air},$

Four Steps of Risk Assessment: Toxicity Assessment

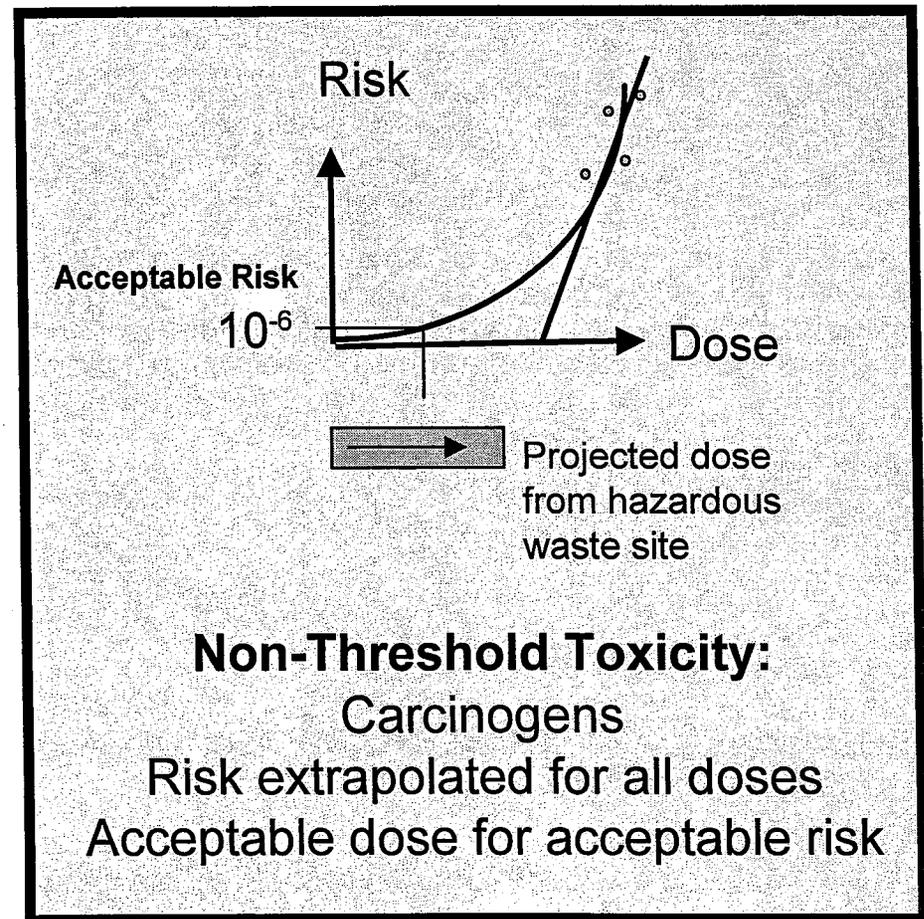
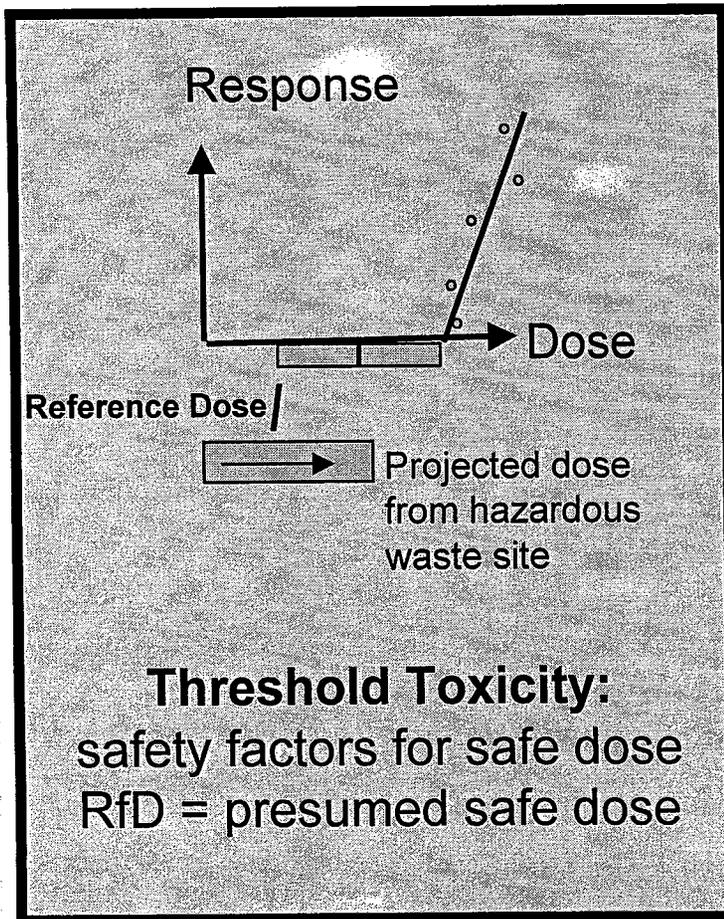




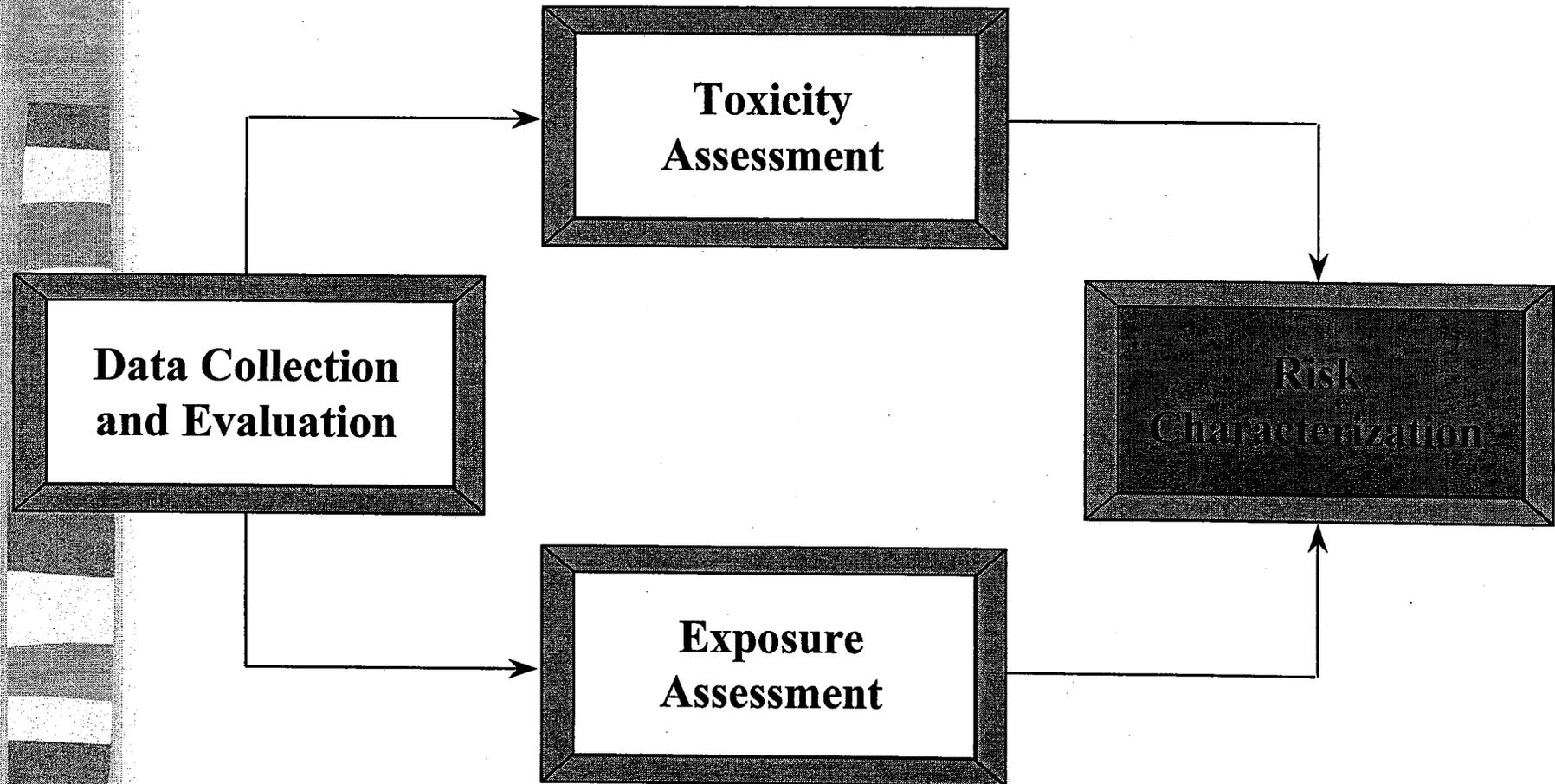
Some Basic Toxicological Concepts

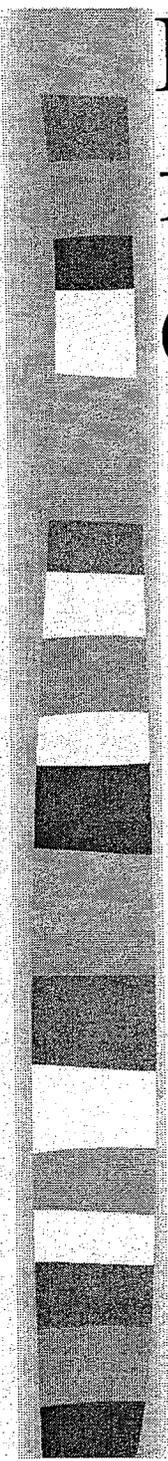
- Two categories of toxic chemicals:
 - Carcinogenic Chemicals
 - Believed to act via a “nonthreshold” mechanism of action. There is a risk is associated with any exposure level.
 - Noncarcinogenic Chemicals
 - Believed to act via a “threshold” mechanism of action. This means that there is a level of exposure (i.e., a threshold) below which it is unlikely to have an effect.

Toxicity Assessment-How Harmful?



Four Steps of Risk Assessment: Risk Characterization



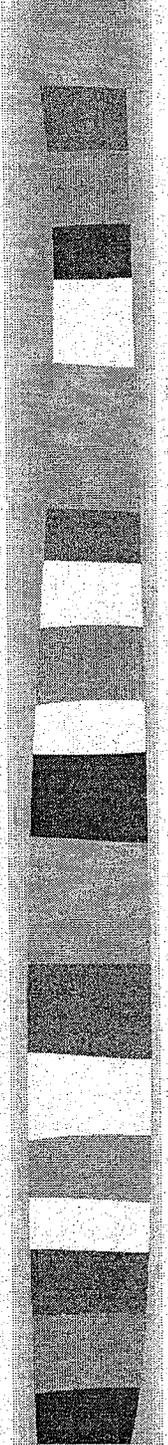


How Do We Quantify Health Effects from Exposure to Noncarcinogenic Chemicals?

For noncarcinogens, the potential for health effects is expressed as a “hazard quotient.”

For a single chemical:

$$\text{Hazard Quotient} = \frac{\text{Intake}_i}{\text{Reference Dose}_i}$$

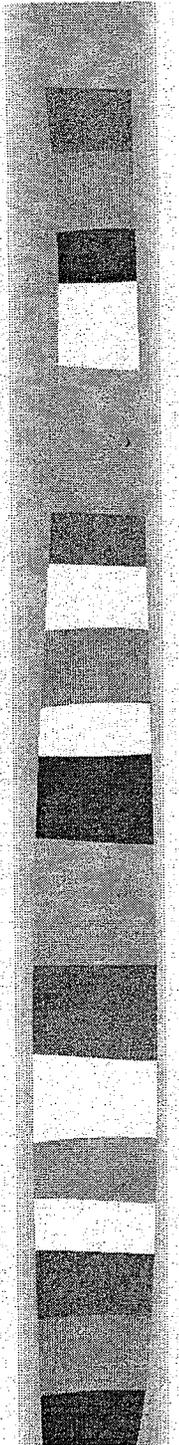


How Do We Quantify Risks from Carcinogenic Chemicals?

For carcinogenic chemicals, the potential for health effects is expressed as “carcinogenic risk.”

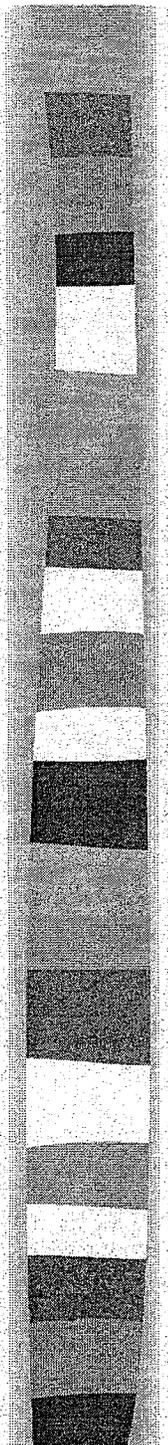
For a single chemical (i),

$$Risk_i = Intake_i \times Slope Factor_i$$



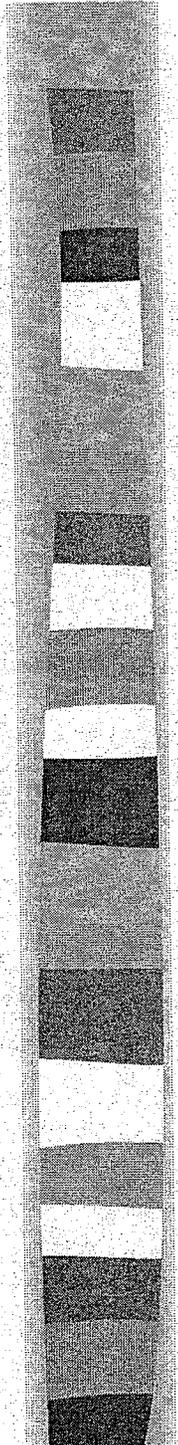
RISK CHARACTERIZATION

- **TOTAL CANCER RISK FOR SITE:-**sum risk over all chemicals and all media
- **TOTAL NON-CANCER HAZARD FOR SITE:-** sum hazard over all chemicals and all media



SCREENING RISK ASSESSMENT

- **SIMPLIFIED- HEALTH PROTECTIVE**
- **IDENTIFY IMMEDIATE THREATS**
- **SCREEN OUT INSIGNIFICANT
AREAS**
- **PRGs**



PRELIMINARY REMEDIATION GOALS (PRGS)

- **GENERIC VALUES CAN BE USED FOR SCREENING**
- **BASED ON RISK ASSESSMENT METHODS**
- **U.S. EPA REGION IX CRITERIA**