

Environmental Health and Land Reuse Certificate

Module 2:

Evaluating Environmental and Health Risks

Agency for Toxic Substances and Disease Registry
(Created in 2020)

Instructors: Laurel Berman, Leann Bing, Sue Casteel

Evaluating Environmental and Health Risks: Objectives

❑ **Definitions**

- Describe the basics of toxicology.
- Describe the basics of epidemiology.

❑ **Best practices**

- Describe Phase I and II environmental site assessments.
- Describe the tiered approach to cleanup.

❑ **Evaluating the risk**

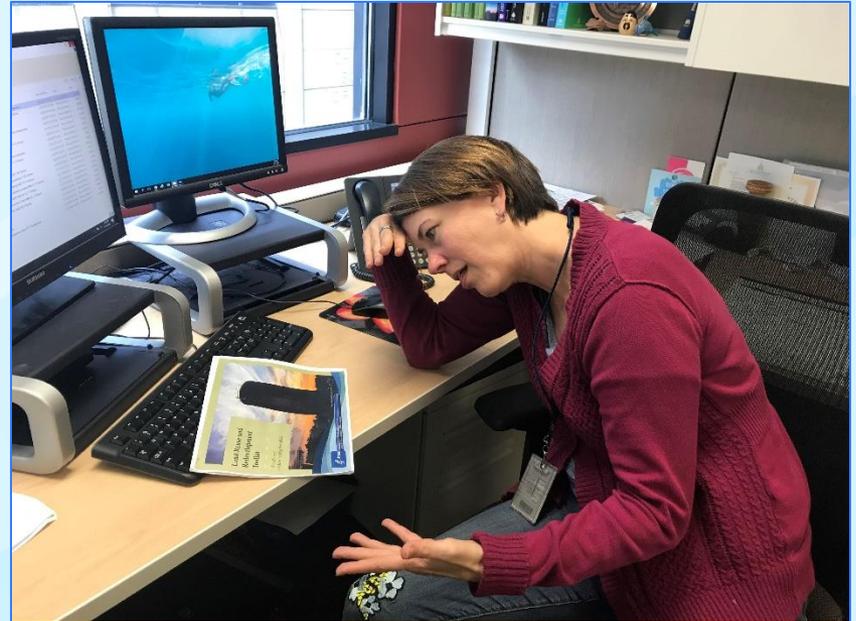
- Describe 4 key steps in risk assessment.
- Describe the ATSDR Public Health Assessment process.

Evaluating Environmental and Health Risks: Test Details

- ❑ **Pre-test**
- ❑ **Post-test: 70% or higher to receive a certificate**

Create a 4-digit number to put on your pre-test and post-test

- Memorize the number or keep a written copy
- Use the same number on both the pre- and post-test



An ATSDR Regional Representative taking a test. ATSDR, 2019.

Evaluating Environmental and Health Risks: Pre-test Module 2

- ❑ Pre-test Module 2
- ❑ Put your memorized 4-digit number on the top right corner of your pre-test



Image of an environmental professional working in the field:
https://www.atsdr.cdc.gov/sites/brownfields/pdfs/Brownfields_Toolkit_Environmental_Professional-508.pdf

Toxicology

DEFINITIONS

Toxicology

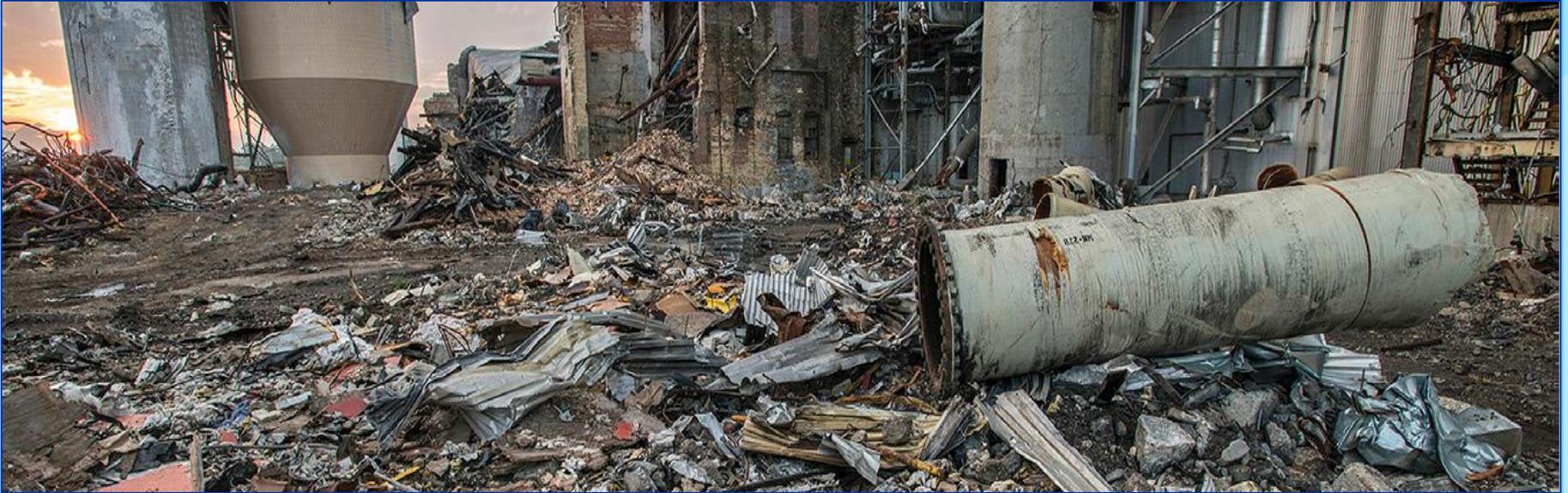


Image of a Brownfield. Lloyd DeGrane, 2014

Toxicity



Toxicity depends on

- Dose
- Duration
- Route of exposure
- Substance shape and structure
- Individual human factors
- **Health status**
- **Sex**
- **Genetics**

Dose and Duration



Dose



- Dose**– Amount of substance that enters the body; amount of substance per body weight (mg/kg)
- Duration** –Amount of time you are exposed to a substance

Dose-response

Dose-response

- Relationship between exposure and health effects

Varies by

- Pollutant
- Individual sensitivity
- Type of health effect



"The dose makes the poison."



Safe Level of Exposure

NOAEL:

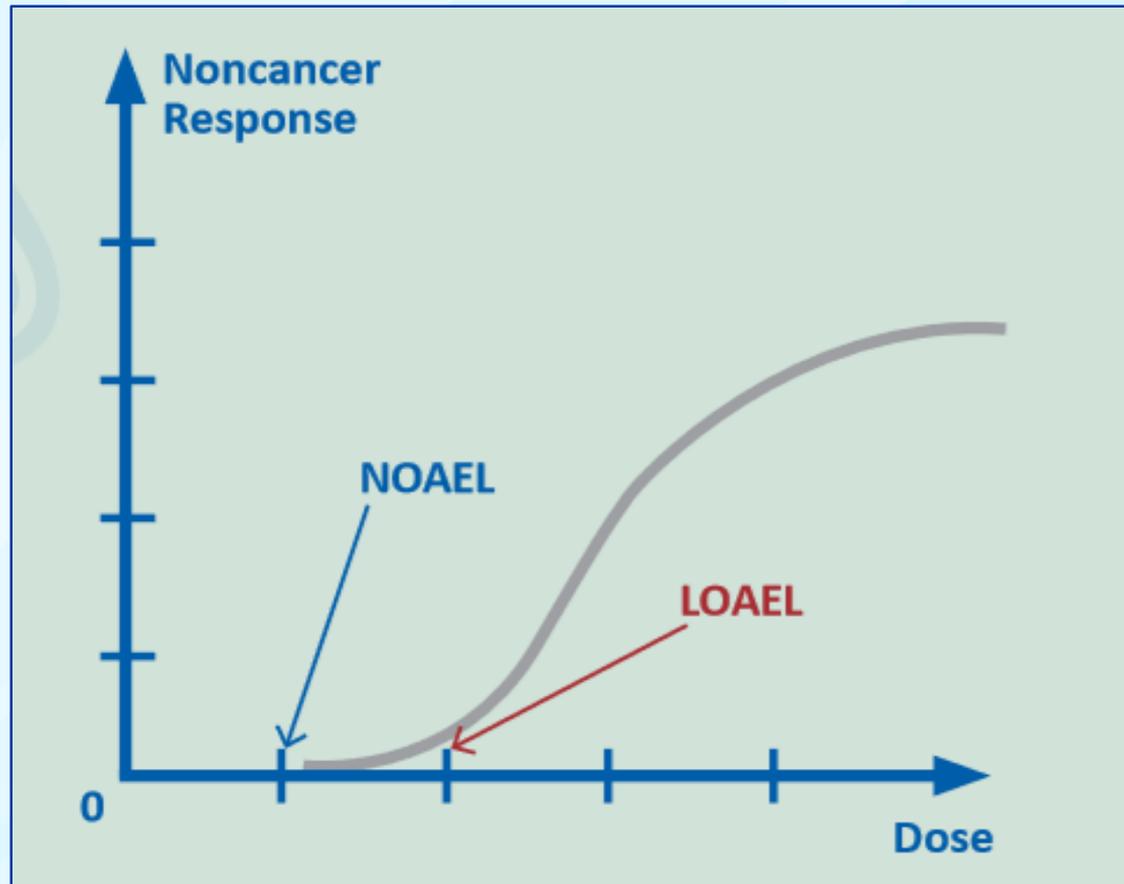
- The “**no observed adverse effect level**” (NOAEL)
- The dose below which harmful (adverse) effects are not seen.

LOAEL:

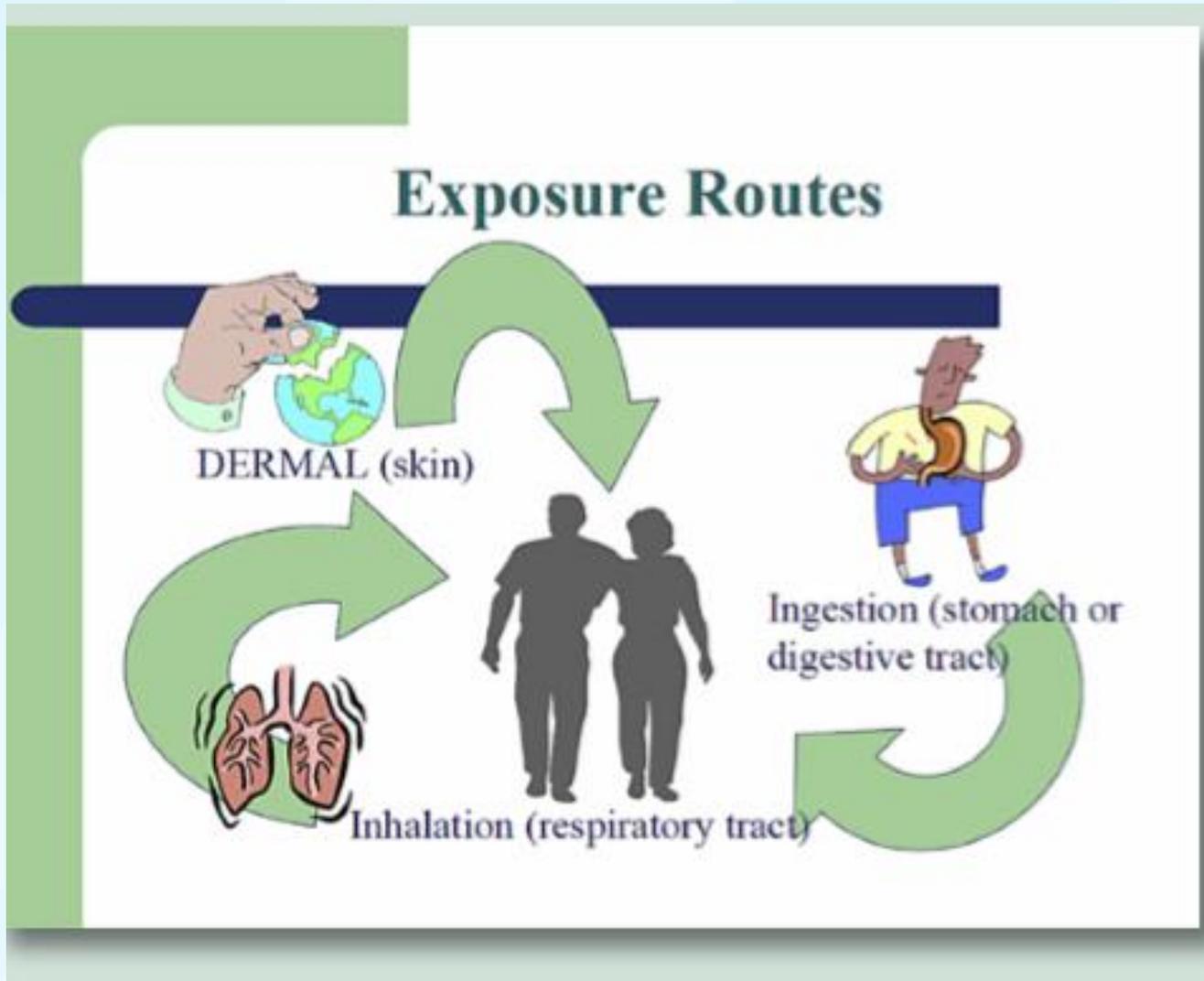
- The “**lowest observed adverse effect level**” (LOAEL)
- The lowest tested dose reported to cause harmful (adverse) effects.

Carcinogens (substances that cause cancer) are assessed differently from non-carcinogens. While carcinogens are considered to have no safe level of exposure, they may have different cancer outcomes and levels of risk.

Dose-response Relationship for Non-cancer Effects



Routes of Exposure



Amount of time exposed: **Acute** (short) or **chronic** (long)



Other Toxicology Resources

- ATSDR Environmental Health Self Learning Module – Toxicology
(<https://www.atsdr.cdc.gov/sites/brownfields/pdfs/toxicology-508.pdf>)
- ToxLearn: A Gateway to Toxicology
(<https://toxlearn.nlm.nih.gov/Module1.htm>)
- Tox Tutor (<https://toxtutor.nlm.nih.gov/>)

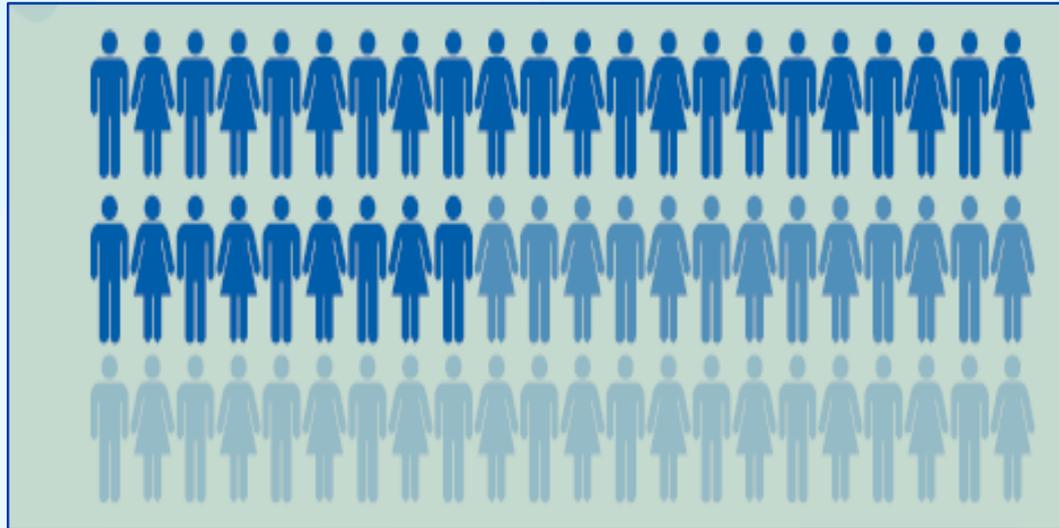
Knowledge Check #1

Select the best answer:

Understanding the harmful effects of substances on humans or animals is important to land reuse and redevelopment because

- a) The level of exposure to certain substances could determine whether a site is safe for reuse or not.
- b) Toxicology information should be withheld from the public.
- c) The chances of humans or animals being exposed to toxic substances on land reuse sites are so small.
- d) The media does not care about reporting this information.





Epidemiology

DEFINITIONS

Epidemiology

Epidemiology tries to determine

- Causes of illness in a population
- Causes of wellness in a population



Environmental Epidemiology

Environmental epidemiology

- Determines detailed disease information related to specific toxicant exposure
- Evaluates environmental and health risks associated with contaminated sites
- Determines if a local disease cluster is related to toxicant exposure



Incidence vs Prevalence

□ Incidence rate

- Number of people **newly** diagnosed
- Particular disease
- Specific time period

□ Prevalence rate

- Number of people **who have the** particular **disease**
- Defined point in time

$$\text{Incidence} = \frac{\text{\# of new cases}}{\text{Population at Risk}}$$

$$\text{Prevalence} = \frac{\text{\# of existing cases}}{\text{Population at Risk}}$$



Knowledge Check #2

Choose all that apply:

Epidemiology can provide useful information to an environmental or health professional who is responsible for communicating with concerned citizens:

- a) Detailed disease information related to specific toxicant exposure.
- b) Evaluation of environmental and health risks associated with contaminated sites.
- c) Studies related to local disease clusters.
- d) Information on their neighbors' health status.

Other Epidemiology Resources

- ATSDR Environmental Health Self Learning Module – Epidemiology
(<https://www.atsdr.cdc.gov/sites/brownfields/pdfs/epidemiology-508.pdf>)
- CDC's Principles of Epidemiology in Public Health Practice, 3rd Ed., An Introduction to Applied Epidemiology and Biostatistics (<https://www.cdc.gov/csels/dsepd/ss1978/>)
- Solve the Outbreak
(<https://www.cdc.gov/mobile/applications/sto/web-app.html>)



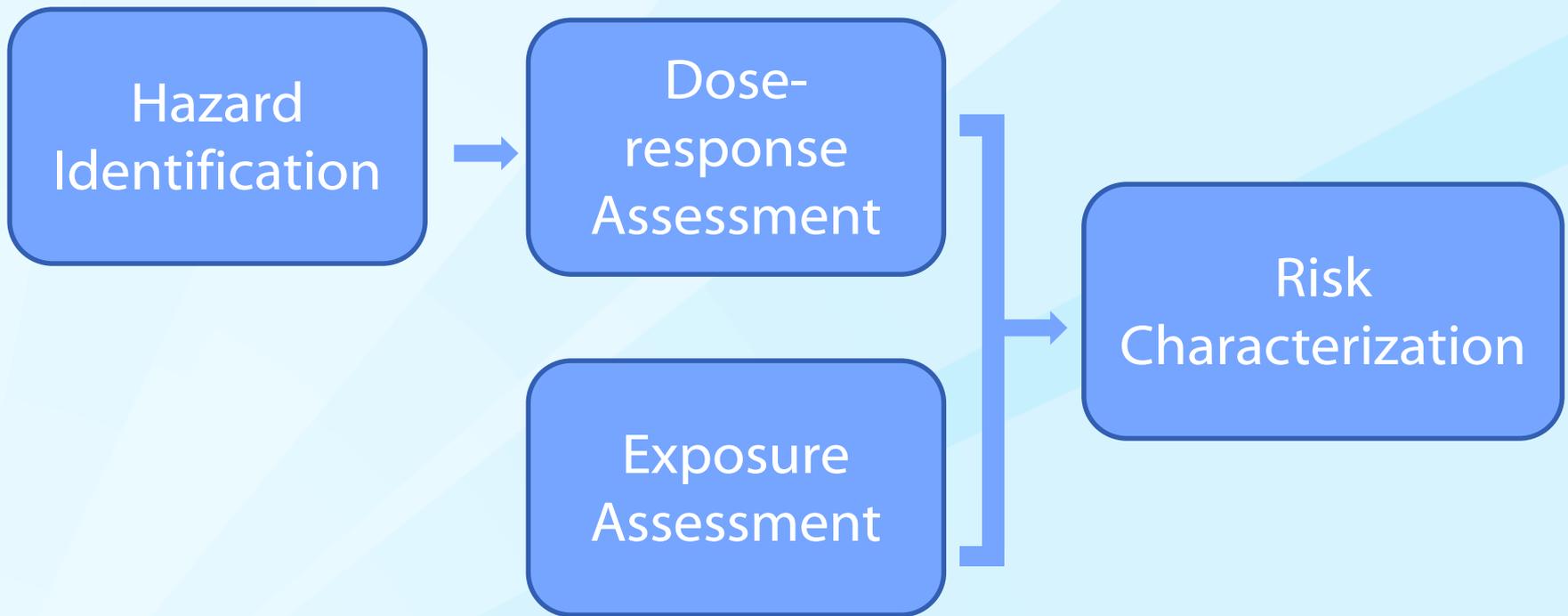


Image of improperly stored drums. Lloyd Degrane, 2019.

Risk Assessment

DEFINITIONS

Risk Assessment

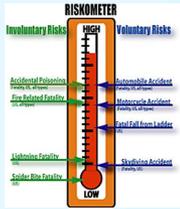




Risk Assessment

Hazard
Identification

What health problems are caused by the pollutant?

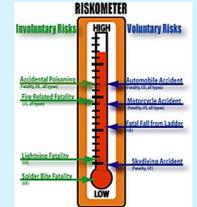


Risk Assessment

Dose-
response
Assessment

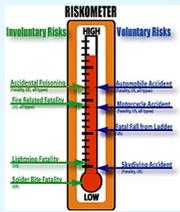
What are the health problems at different exposures?

Risk Assessment



Exposure
Assessment

- How much of the pollutant are people exposed to during a specific event?
- How many people are exposed?



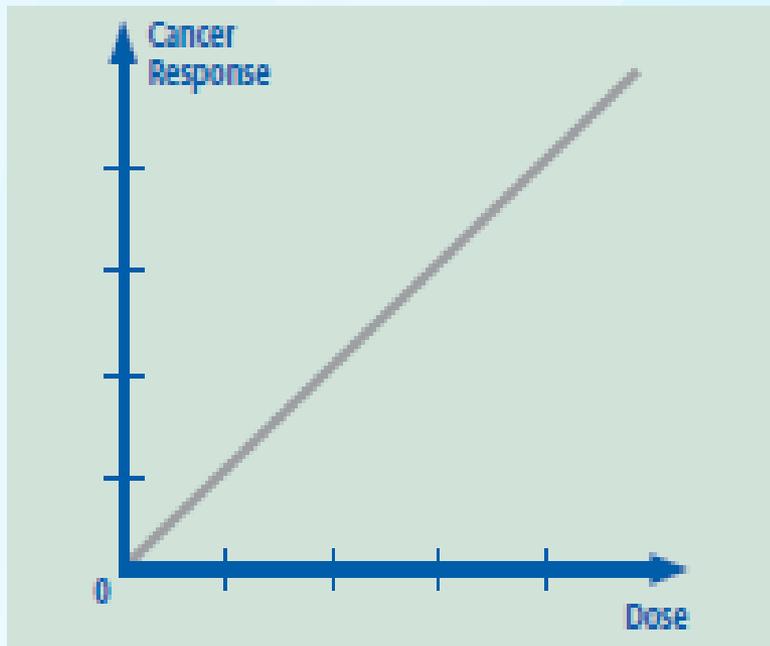
Risk Assessment

What is the extra risk of health problems in the exposed population?

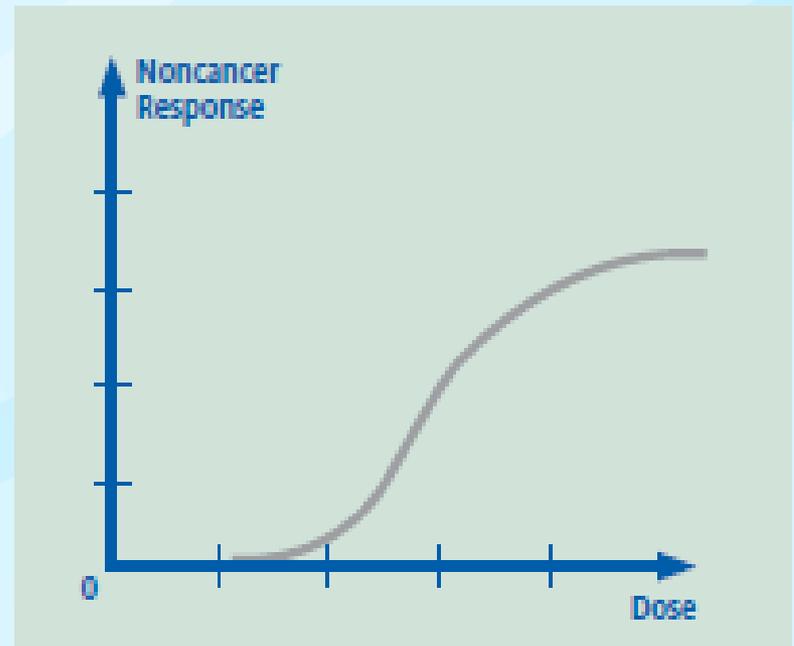
Risk
Characterization

Risk Assessment

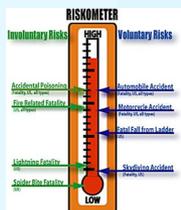
Risk
Characterization



Cancer Health Effects



Non-Cancer Health Effects



Other Risk Assessment Resources

- ATSDR Environmental Health Self Learning Module – Risk Assessment
(https://www.atsdr.cdc.gov/sites/brownfields/pdfs/risk_assessment-508.pdf)
- EPA's Risk Assessment Website (<https://www.epa.gov/risk>)
- EPA's Integrated Risk Information System (IRIS)
(<https://www.epa.gov/iris>)
- Risk Assessment Information System (RAIS)
(<https://rais.ornl.gov/>)

Environmental Site Assessment

BEST PRACTICES

Environmental Site Assessments (ESA)

☐ Phase I ESA

- Identifies potential environmental concerns
- Exercises “due diligence”
- Conducts “all appropriate inquiry”

☐ Phase II ESA

- Identifies actual contaminants
- Conducts sampling
- Includes laboratory testing



Phase 1 Environmental Site Assessment (ESA)

□ Phase I ESA

- **Records searches**
 - Sanborn fire insurance maps
 - USGS topographical map
 - Street directories
- **Interviews**
 - Owners
 - Tenants
 - Regulators
 - Health departments
- **Site visit**



Environmental Professionals engaged in a Phase 1 ESA.
Lloyd DeGrane, 2019.

Site Visit: Recognized Environmental Conditions (RECs)

- **During the site visit, note RECs**
 - E.g., oily spill
 - Possible PCB-containing material
 - Possible lead-based paint or asbestos
 - Odor
 - Drums
 - Other waste



Brownfields sites that may have recognized environmental conditions. Lloyd DeGrane, 2019.

Phase II Environmental Site Assessment (ESA)

□ Phase II ESA

- Sample/test for specific hazards identified in Phase I ESA
- Evaluate environmental concerns
- Determine whether a hazardous substance was released

□ Phase II ESA components

- Develop statement of objectives
- Create a conceptual model (hypothesis of how contamination came and migrated)
- Write a report (sampling plan, monitoring well tests, etc.)



Knowledge Check #3

Phase I ESA includes sampling soil and water on the site and testing the samples for contaminants.

- a) True
- b) False

Knowledge Check #4

Select all that apply:

Phase I ESA typically includes the following (choose all that apply):

- a) Subsurface soil testing
- b) Records searches
- c) Site visit
- d) Contamination evaluation
- e) Underground storage tank (UST) sampling
- f) Interviews

Knowledge Check #5

Select the best answer:

In a Phase II ESA, the conceptual model is

- a) The same as a sampling plan
- b) The goals for the assessment
- c) The hypothesis for how target analytes may have arrived at and migrated through a site
- d) The explanation of findings from the assessment

Phase 1 and Phase 2 ESA Activities

Recognized environmental conditions –Guest instructor or video, if available



Environmental Professional discussing potential site contaminants. Lloyd DeGrane, 2014.

Phase 1 and Phase 2 ESA

- ❑ There are piles of paper squares at your tables
- ❑ Sort the paper squares into **Phase 1 ESA** or **Phase 2 ESA**
- ❑ We will come and **check** to see how you are doing
- ❑ Be prepared to **explain** your answers



Students learning the importance of environmental site assessment. Lloyd DeGrane, 2014.

Tiered Approach to Cleanup

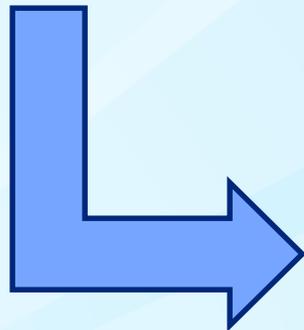
BEST PRACTICES

A Tiered Approach to Cleanup

Tier 1: Environmental impacts

Tier 2: Site-specific data

Tier 3: Site-specific risk assessment



Goal:

- Similar levels of protection
- Cost effective

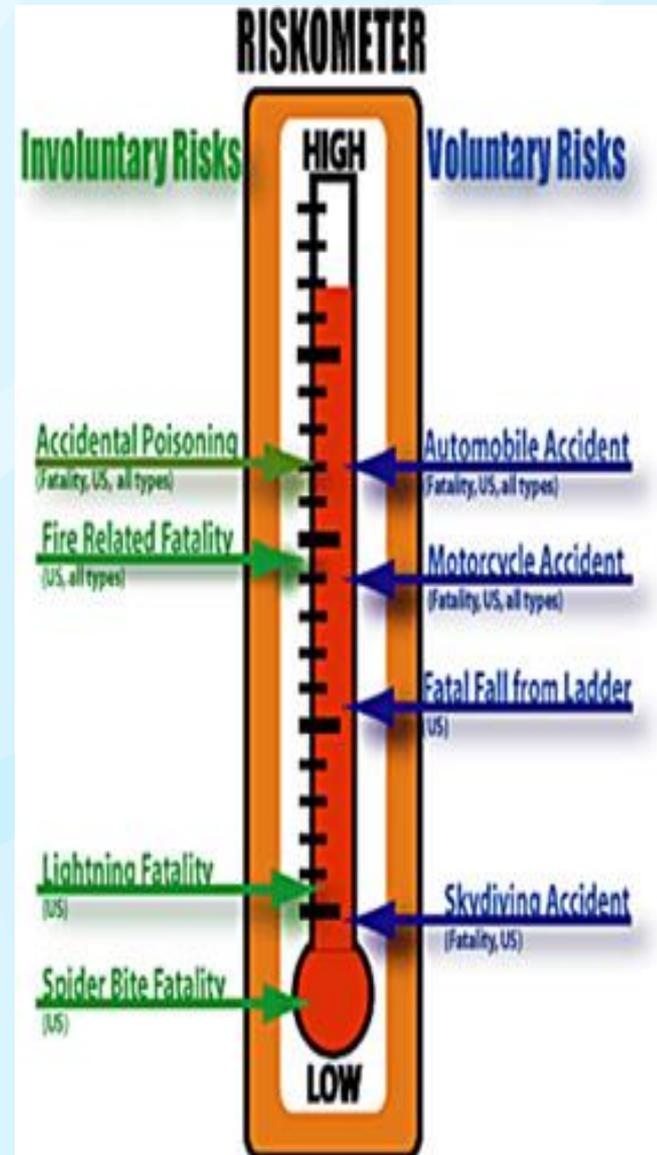
Knowledge Check #6

The goal of all tiers in the **tiered approach** to cleanup is to achieve similar levels of protection. However, when moving to higher tiers, the assumptions of earlier tiers are replaced with more realistic site-specific assumptions resulting in more efficient and cost-effective actions

- a) True
- b) False

Risk Assessment

EVALUATE THE RISK





ATSDR Public Health Assessment

EVALUATE THE RISK

Public Health Assessment



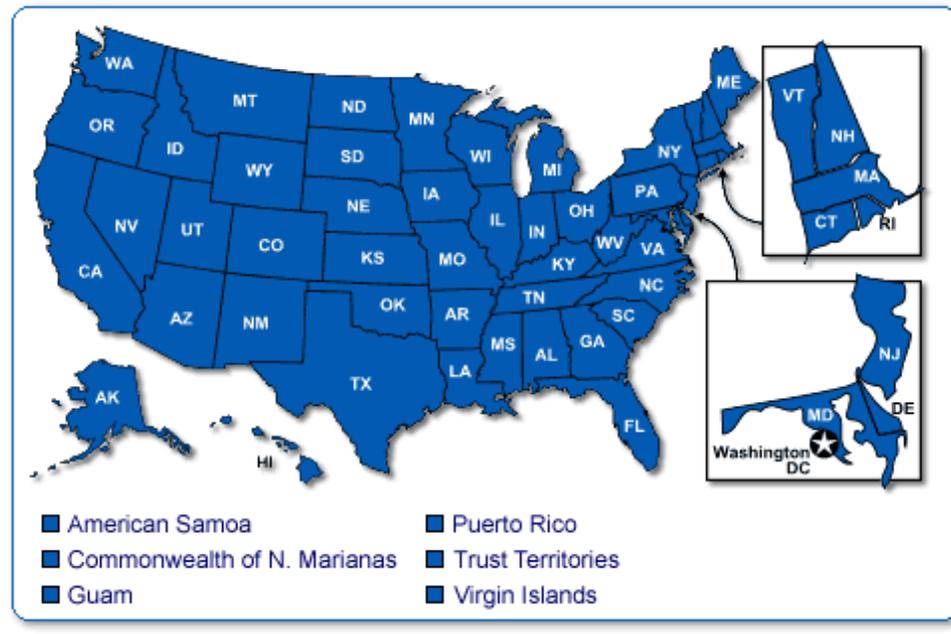
https://www.atsdr.cdc.gov/videos/health_assessment_process.htm

ATSDR and APPLETREE Partners

- ❑ **Identify** exposure pathways at specific sites
- ❑ **Evaluate** environmental and health data to identify potential health risks
- ❑ **Recommend** ways to prevent exposures
- ❑ **Educate** affected communities and local health professionals about site contamination and potential health effects



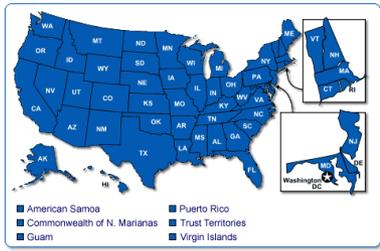
ATSDR Public Health Assessment (PHA)



ATSDR PHA evaluates

- Hazardous waste sites
- Hazardous substances
- Health outcomes
- Community concerns

<https://www.atsdr.cdc.gov/hac/pha/index.asp>

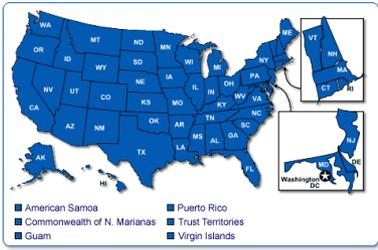


ATSDR Petition Program

Petition ATSDR to investigate

- Whether there are chemicals in your community
- If those chemicals could get into your body
- If they could affect your health

<https://www.atsdr.cdc.gov/hac/petitionatsdrdchi.html>



ATSDR Health Assessor Training

ATSDR health assessor training topics:

- Mission and Community
- Exposure Pathways and Toxicological Evaluation
- Evaluation of Health Data and Development of Conclusions and Recommendations

<https://www.atsdr.cdc.gov/training/public-health-assessment-overview/html/>

Risk Assessment vs. Public Health Assessment

Risk Assessment	Public Health Assessment
Extent of contamination.	Identify possible harmful exposures.
Numeric estimate of risk without cleanup.	Estimate numeric risk.
Current and potential future exposures.	Conduct past, current, and potential future exposure assessment.
All contaminated media regardless of exposure.	Develop toxicological assessment specific to community.
Standard protective exposure assumptions.	Review community health concerns.
	Review health outcome data.
	Provide recommendations to reduce or prevent exposures.

Knowledge Check #7

A public health assessment (PHA) evaluates a hazardous waste site for hazardous substances, health outcomes, and community concerns.

- a) True
- b) False

Brownfields/Land Reuse Sites: Case Examples

- ❑ **Guest lecturers** can talk about some of their sites
- ❑ **Video examples** can be inserted (if available)

TOOLS

Tools and Resources

- ❑ **ATSDR Brownfield and Land Reuse Site Tool**
 - (https://www.atsdr.cdc.gov/sites/brownfields/site_inventory.html)
- ❑ **ATSDR Toxicological Profiles and ToxFAQs**
 - (<https://www.atsdr.cdc.gov/substances/index.asp>)
- ❑ **ATSDR Action Model**
 - (<https://www.atsdr.cdc.gov/sites/brownfields/model.html>)
- ❑ **Health Impact Assessment**
 - (<https://www.cdc.gov/healthyplaces/hia.htm>)
- ❑ **PACE EH**

Tools and Resources

- ❑ **Choose Safe Places for Early Care and Education**
 - (<https://www.atsdr.cdc.gov/safeplacesforECE/index.html>)
- ❑ **Community Mapping Tools**
 - EnviroAtlas (<https://enviroatlas.epa.gov/enviroatlas/interactivemap/>)
 - EJScreen (<https://www.epa.gov/ejscreen>)
- ❑ **Community Health Status Indicators**
 - NCEH Tracking Program
(<https://www.cdc.gov/nceh/tracking/BetterInfoBetterHealth.htm>)
 - Community Health Rankings and Roadmaps
(<https://www.countyhealthrankings.org/explore-health-rankings#county-select-38>)

Review

- ❑ **Review your slides and knowledge checks**
- ❑ **Post-test is next**
 - Must score 70% to receive a certificate
 - Can take the test multiple times

Thank you!

Laurel Berman, laberman@cdc.gov

Leann Bing, kbing@cdc.gov

Sue Casteel, aov2@cdc.gov