EHLR Module 2: Evaluating Environmental and Health Risks

Laurel:

Hi, I'm Laurel.

Welcome to module two, "Evaluating Environmental and Health Risks."

Now, let's talk about the objectives for evaluating environmental and health risks.

Our first objective involves definitions.

It is to describe the basics of toxicology and epidemiology.

A general understanding of these topics is useful for understanding potential exposures to chemicals at land reuse sites.

Our second objective is to learn best practices related to site assessment.

You should be able to:

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

Site assessments are required under the US EPA's Brownfields Program.

The tiered approach to cleanup is a risk-based approach to cleanup of brownfields site contaminants.

Our third objective is to evaluate the risk of site contamination.

You should be able to:

Identify and describe the similarities and differences of the 4 key steps of risk assessment and ATSDR's public health assessment process.

Environmental health professionals need a basic understanding of environmental health topics to work in land reuse.

Our first topic is Toxicology.

If a land reuse site is being evaluated for contamination, you may work with environmental engineers, scientists, toxicologists, health assessors, planners, epidemiologists, and other environmental or health professionals.

Your knowledge of toxicology and other environmental health fields may help your understanding of environmental and health assessments related to land reuse sites.

A simple definition of toxicology is the study of poisons.

Toxicology is the study of the harmful effects of chemical substances and radiation on humans or animals.

This photograph depicts a brownfield site in the Midwest.

It is an image of a paper mill on Lake Michigan, and it's looked this way for years.

Paper mills have a variety of toxic substances, including chlorinated chemicals.

The word "toxicity" describes the degree to which a substance is poisonous or can cause harmful effects.

Toxicity depends on a variety of factors, such as dose, duration, frequency of exposure, route of exposure, individual susceptibility, and exposure to other substances.

The dose is the amount of a substance that enters the body over a specified time.

In general, the higher the dose or longer the time someone is exposed, the greater the likelihood that a health effect will occur.

Duration and frequency of exposure are the length of time and how often someone is exposed.

For example, one cigarette at one time may have minimal effects on your body.

If you smoke a pack of cigarettes every week for 30 years, then you could have a serious health effect, such as decreases in lung function or cancer.

The route of exposure refers to how a chemical gets into your body.

The most common routes include oral ingestion or eating, inhalation or breathing, and dermal contact or touching.

Individual human factors affect how a substance is absorbed, metabolized, and excreted by the body.

There are other individual factors that also affect toxicity.

These include differences in health status, sex, genetics, and sensitivity.

The dose is often measured as milligrams (or micrograms) of the substance per body weight in kilograms.

For example, when you drink water containing a chemical substance, scientists will divide the amount you ingest by your body weight to get a dose in milligram of chemicals per kilogram of your body weight.

Duration is the amount of time you're exposed to a substance.

We typically think of duration in days, months, or years, but it can also be very short, such as in minutes or hours.

Frequency of exposure is how often you are exposed during that time period.

ATSDR develops health guidelines based on three exposure durations.

The shortest is acute duration, which are exposures up to and including 14 days.

The next duration is intermediate, which are exposures from 15 days to 364 days.

The final duration is exposures that are 365 days or more.

Dose and duration are really important, especially when considering how toxic the substance is.

Dose-response is a relationship between exposure and health effects.

Usually the larger the dose, the greater the effect or response.

Even substances we use all the time, like salt, can be a poison if the dose is high enough.

This is the meaning behind the famous toxicologist, Paracelsus' statement, "the dose makes the poison."

For example, if I had a bad headache and I take two pain relief tablets and my headache starts to go away, I'm probably at the right level for an effect.

If I take twenty or thirty tablets, I may be in the hospital with an overdose.

Dose response varies by pollutant and individual sensitivity.

It also varies by the type and severity of health effect.

This includes where the pollutant or contaminant impacts your body as well.

There are different effect levels in toxicology.

The no observed adverse effect level or NOAEL, is the dose below which the harmful or adverse effects of a substance are not seen in a study.

For example, taking two tablets of Ibuprofen could be the NOAEL.

Here is the continuation of your transcript with all timestamps and numbering removed:

The lowest observed adverse effect level or LOAEL is the lowest tested dose of a substance in a study that has been reported to cause adverse health effects.

For example, the American Heart Association guidelines are to consume no more than 2300 milligrams sodium or one teaspoon of salt per day.

For adults with high blood pressure, they recommend no more than 1500 milligrams, which is between one half to three quarters teaspoon of sodium per day.

Excessive salt intake has been shown to increase fluid retention and contribute to high blood pressure in adults with hypertension.

Substances that can cause cancer—carcinogens (substances that cause cancer) are assessed by risk ranges.

For example, if the theoretical risk range is less than 1 in 1,000,000 persons similarly exposed, there is no concern for increased cancer risks.

This slide summarizes dose-response for cancer and non-cancer effects.

The first graph, on the left, shows a straight line that predicts cancer risk.

There's typically no NOAEL or LOAEL at the lower end of the dose response curve for cancer.

We use what is called a cancer slope factor to estimate cancer risk at very low exposure levels where data do not exist.

For cancer-causing chemicals, the cancer slope factor assumes that even a very low exposure to the chemical can increase the risk of cancer for most carcinogens.

The straight dose-response line assumes that for each unit increase in exposure or dose, there is an increase in cancer risk.

The second graph, on the right, shows the dose-response curve for non-cancer effects.

It is an S-shaped curve, with a NOAEL and LOAEL.

At very low doses, some adverse effects are transitory, and the body will recover once exposure stops.

At higher doses, more serious effects might occur that lead to permanent organ damage.

An example of transitory effects would be the gastrointestinal effects like nausea and vomiting caused from ingesting arsenic-contaminated soil.

Long-term exposure to arsenic-contaminated water, however, has been shown to cause permanent neurological effects and skin cancer.

In summary:

For cancer effects, we use a straight-line dose-response curve and estimate a numerical cancer risk.

For non-cancer effects, we use the S-shaped dose-response curve with a NOAEL and LOAEL with more serious effects likely at higher doses.

The three images on this slide show three different routes of exposure.

These are:

- Inhalation or breathing, represented by the smokestacks.
- Ingestion or eating, represented by the bowl of food.
- Dermal or skin contact, represented by children putting plants in soil.

Environmental exposures are often divided into two categories based on the amount of time and how frequently people are exposed:

- Acute exposure is short-term, for example, a few minutes, hours, or days.
- Chronic exposure is long-term, for example several years, or a lifetime.

There are five elements of the exposure pathway, and each is evaluated to determine if people could be exposed to site-related contamination.

The right side of the slide is a screenshot of a video about the five parts of the exposure pathway.

The link is:
https://www.youtube.com/watch?v=LG5MdCuro6Y

Let’s pause for a few minutes so you can watch the video.

There are five parts of the exposure pathway, and each is evaluated to determine if people could be exposed to site-related contamination.

The first part identifies a contaminant source or a place where the chemical was released.

The next part looks at how the chemical might move or change in the environment.

Some chemicals break down when exposed to air, water, or microorganisms such as bacteria. Air, soil, and water are the major elements that can move or change a chemical.

Sometimes the chemical can get into plants and animals that people eat.

So we also consider how eating contaminated plants and animals could affect a person's health.

The third part looks at where people could come in contact with the chemical.

Some examples of this include outdoor or indoor air, drinking water taps, residential yards where the chemical was spilled, and the food supply.

The fourth part looks at how the chemical enters a person's body.

In other words, is it possible to inhale or breathe in the chemical, to drink or ingest the chemical from water, soil, or the food supply?

…or to absorb the chemical by touching water or soil?

The fifth and final part in the exposure pathway evaluates whether there are people in the community who could be exposed.

For example, if someone uses a public water supply, they would not be exposed to any contaminated groundwater from an old well that is on their property that no one uses.

When we assess exposure pathways, we also want to assess the extent of community exposure to the land reuse site or source.

For example, how widespread is the contamination?
How many people are exposed?
How close are people to the contaminant?
Where's the nearest daycare center?
Where's the nearest nursing home?
Which way does the wind blow?
Could dust migrate from the site?
Is there runoff from the site?

Now, I'll turn it over to Huda to discuss toxicology resources.

Huda:

Hi, I'm Huda.

We have several Environmental Health Resources.

The first is on our brownfields and land reuse website under the "For Health Agencies" tab.

This site includes self-learning modules on toxicology, epidemiology, risk assessment, and other topics.

The link is:
https://www.atsdr.cdc.gov/land-reuse-health-program/php/classroom-training/environmental-health-resources-self-learning-modules.html

Next, we have **ToxLearn: A Gateway to Toxicology** that can be accessed at the following link:
https://toxmsdt.vetmed.ucdavis.edu/toxicology

Third, we have the **Toxicological Outbreak Investigation Course and Toolkit** at:
https://www.cdc.gov/environmental-health-studies/php/training/index.html

Let's complete the first knowledge check.

Please 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 pollutants are minimal on land reuse sites.

Let's pause for 10 seconds to allow time to answer the question.

The answer is A) The level of exposure to certain substances could determine whether a site is safe for reuse or not.

Now, I will review epidemiology.

Epidemiology studies the distribution and determinants of health-related states, or illnesses, among populations.

Environmental epidemiology is concerned with environmental conditions or hazards that may pose a health risk to populations.

Environmental epidemiology determines detailed disease information related to toxic substance exposure.

It evaluates environmental and health risks associated with contaminated sites.

For example, if children were exposed to arsenic in soil at their local playground, they may experience nausea, vomiting, and skin lesions, among other health effects.

A basic understanding of epidemiology and available resources may be useful to address community concerns and help you to alleviate their fears.

Incidence and **prevalence** of a disease or health condition are important concepts in understanding disease.

Incidence quantifies how many people in a specified geographic area have been newly diagnosed with a particular disease or health condition during a specific time period and is often expressed as a rate.

Incidence reflects how fast an individual goes from a non-diseased state to a diseased state over a certain period of time.

Prevalence quantifies the proportion of both old and newly diagnosed cases of a health outcome occurring in a specified geographic area during a specific time period.

It is also expressed as a rate and is a measure of both survival and newly acquired disease occurring in a population over a certain time period.

Thus, **incidence** refers to the proportion of newly diagnosed cases, while **prevalence** refers to the proportion of both existing and new cases occurring in a community over a specific time period.

Let's complete Knowledge Check 2.

Choose all that apply:

Epidemiology can provide which of the following information to an environmental or health professional who is responsible for communicating with concerned citizens:

A) Detailed disease information related to a toxic chemical exposure.
B) Environmental and health risk assessments associated with contaminated sites.
C) Studies related to local disease clusters.
D) Information on their neighbors' health status.

Let's pause for 10 seconds to allow time to answer the question.

The answers are A, B, and C

- Detailed disease information related to a toxic chemical exposure.

- Environmental and health risk assessments associated with contaminated sites.

- Studies related to local disease clusters.
- Evaluation of environmental and health risks associated with contaminated sites.
- Studies related to local disease clusters.

Listed on this slide are some helpful epidemiology resources available at CDC and ATSDR.

The first resource is a self-learning module on epidemiology: *For Health Agencies ATSDR Environmental Health Self Learning Module: Epidemiology* and other modules and resources.

It is available at:
https://www.atsdr.cdc.gov/land-reuse-health-program/php/classroom-training/environmental-health-resources-self-learning-modules.html

The second resource is a fun game, *Solve the Outbreak*. It is available at:
https://www.cdc.gov/mobile/applications/sto/web-app.html

I will now turn the presentation over to Shereitte, who will review Risk Assessment.

Shereitte:

Hi, I'm Shereitte.

Assessing the risk of exposure to contamination is a big part of how we determine how dangerous a land reuse site may be.

The image on the slide is of improperly stored waste drums in the Missouri Bootheel.

The drums contain waste from a cotton gin that was being disassembled.

The drums are in bad shape.

They are decayed, rusty, crushed, and some have liquid that has leaked into the surrounding padding and soil.

This is the area where people drive into town.

So, it is quite visible.

The soil is stained below the drums, likely from leaks.

When Laurel was there, children were playing on the property, riding around on an all-terrain vehicle.

There are some small buckets among the drums.

Sometimes, liquid and solid waste in small buckets could be corrosive.

It's clear these drums have not been stored properly.

There aren't many labels on the drums.

One label says, "gin cleaning fluid." This could be a volatile solvent.

Risk is defined as the possibility that something will cause harm.

Risk assessment is an analysis of the potential adverse health effects, past, current or future, caused by hazardous substance releases from a site.

This is done under the assumption that there are no actions to control or mitigate releases.

The basic elements of risk assessment are:

- Hazard identification
- Exposure assessment
- Dose-response assessment
- Risk characterization

We will discuss each element shortly.

During **Hazard Identification**, we ask:
What are the contaminants of concern at the site?
What are the health problems potentially caused by exposure to the pollutant?
We can determine adverse health effects of that chemical.

In the **Dose-Response Assessment**, we ask:
What are the health problems at different exposures?
Remember: increasing exposure level or dose combined with the duration and frequency of exposure may increase the harm or risk.

In the **Exposure Assessment**, we ask:
How much of the pollutant are people exposed to during a specific time period?
How many people are exposed?
This includes the frequency (how often) and the duration (how long) they might be exposed.

In the **Risk Characterization**, we ask:
For the exposed or potentially exposed population, how has the risk of health problems increased?

We review outputs from dose-response and exposure assessments.

We ask:
What are the extra risks of health problems from exposure?
What is the impact?

For example, we may obtain data from actual environmental measurements, such as metals in soil.

We may also assess exposure in people, such as conducting blood lead testing.

We compare these findings to established health values, such as regulatory levels.

We try to quantify the overall risks from exposure to individual chemicals and from exposure to a mixture of different chemicals.

Then we ask:
What are the cancerous and noncancerous health risks?

Let’s revisit the dose-response graphs from our earlier review of toxicology.

For cancer-causing chemicals, often very low exposure to the chemical can increase the risk of cancer.

The straight dose-response line on the slide assumes that for each unit increase in exposure (or dose), there is an increase in cancer risk.

For noncancer harmful effects, animal and human studies will identify a dose or concentration that’s a **NOAEL** means no observable adverse effect level where harmful effects were not observed in the study.

Studies can also identify a **LOAEL**, which is the lowest dose or concentration in that study where harmful or adverse effects were observed.

When we review all the studies, we’ll often identify a part of the dose-response curve where we don’t see harmful effects.

That's why you see a flat line initially that starts to go up as studies identify a series of LOAELs.

LOAEL means *lowest observable adverse effect level*.

This is the S-curve on the slide.

At very low doses, the body often can repair damage caused by the chemical.

However, the dose at which there is an effect varies depending on the chemical, the individual, and the type of health effect.

Here are some risk assessment resources:

- **ATSDR’s Environmental Health Self Learning Module – Risk Assessment**
  Available at:
  https://www.atsdr.cdc.gov/land-reuse-health-program/php/classroom-training/environmental-health-resources-self-learning-modules.html

- **EPA's Risk Assessment Website**
  Learn the basics about environmental risk assessments for the public, with links to EPA tools and guidance.
  Available at:
  https://www.epa.gov/risk

- **Integrated Risk Information System (IRIS)**
  EPA's IRIS is a human health assessment program that explores the potential health effects of environmental contaminants.
  Available at:
  https://www.epa.gov/iris

- **Risk Assessment Information System (RAIS)**
  The RAIS is a website that provides risk tools and information to conduct human health and ecological risk assessments. This website has several trainings, including "What is Risk Assessment?" and the RAIS Main Tutorial. Additionally, there is a PowerPoint presentation available under "Training Coursework PowerPoint Presentation" which details how the RAIS website can be used effectively to conduct a risk assessment..
  Available at:
  https://rais.ornl.gov/

Now we will move onto the **Environmental Site Assessment (ESA)** process.

Before the redevelopment of land reuse sites, an ESA is conducted by an environmental professional to understand the potential for contamination.

An environmental professional may need to determine the health risks associated with exposure to potential contamination to protect the health of people who live near or access the site.

This could include identifying a release or threatened release of hazardous materials into structures on the property, into air, or into soil and groundwater or surface water on or near the property.

There are two phases in an Environmental Site Assessment:

- **Phase I ESA** is sometimes referred to as due diligence or all appropriate inquiry. It identifies potential environmental concerns before acquiring a property.

- **Phase II ESA** identifies actual contaminants through laboratory testing of soil, water, and air samples.

I will now turn it over to Laurel to discuss environmental site assessment in more detail.

Laurel:

The EPA requires that only licensed environmental professionals conduct Phase I and Phase II ESAs following ASTM International Standards ASTM E1527-13 and ASTM E1903-11.

During the due diligence process of the Phase One E-S-A, the environmental professional evaluates the property to identify potential environmental contamination.

They also assess the property for potential liability for any contamination present.

Phase I establishes past and current uses of the site, as well as activities at the site and surrounding area.

They may use Sanborn fire insurance maps, topographical maps, and street directories.

Much of this information is also available online.

The environmental professional may interview site owners, tenants, environmental regulators, and health departments.

The photo on the right of the slide is of an actual Phase I E-S-A that students from Diné', or Navajo, College participated in.

This was the site visit. It was done at a site in Navajo Nation.

In the image, we are looking at an old burn pit. Someone may have burned lead painted wood or plastics.

That was the only thing that really caused any concern during our Phase I that needed further investigation.

During the site visit, take note of **Recognized Environmental Conditions (RECs)**. R-E-Cs include things like

An oily spill.

Possible poly chlorinated bye fennel, or P-C-B containing material, such as a distribution transformer on a utility pole Possible lead-based paint, which tends to be thick and curl a bit.

Or there may be asbestos in siding or roofing material R-E-Cs also include odor, drums that may be in bad shape or have leaked, and other waste.

It's also important to note what is in and around the site. For example:

- What's next door to the site?
- Is there a daycare center?
- A school?
- A playground?

The two images on the right are of brownfields sites that may have recognized environmental conditions.

One is an old service station showing peeling paint. It also may have areas where underground tanks leaked petroleum.

The other is a fenced site, which was used as some type of pumping or lift station. It may need further investigation.

If the Phase I ESA indicates possible contamination from hazardous materials, the site may require a Phase II ESA.

Phase II is not required to satisfy the All Appropriate Inquiry. However, Phase I provides an introductory framework for evaluating a site's potential environmental contaminants.

A Phase II ESA provides a more complete understanding of the contamination that may be present on the site.

In the Phase II ESA, you can:

- Sample or test for specific hazards identified in the Phase I ESA.
- For example, you may take some soil samples.
- Evaluate environmental concerns and try to determine how much of the site may be contaminated.
- Determine if there was a hazardous substance release.

For example, if solvent was disposed of in unlined shallow areas, the solvent may have migrated through the soil pores to groundwater beneath the site and then eventually moved downgradient, potentially impacting nearby private wells or creating a vapor intrusion pathway at nearby homes and businesses.

If a Phase II ESA is necessary, an environmental professional must meet the following requirements:

- Develop a **Statement of Objectives** to minimize confusion about the scope of the ESA Two.
- The goals of the assessment must be agreed upon by both the property owner and the certified environmental professional.
- A **Conceptual Model** is a key component of a Phase II ESA.
- It is performed using the scientific method.
- It requires the certified environmental professional to hypothesize how target analytes — substances whose chemical constituents are being identified and measured — would have been released and migrated to the soil, groundwater, or air.
- This process ensures that evaluation activities are appropriately performed.

- It also provides assurance that if a substance is not detected, it is most likely not present—provided the detection limits are low enough.

The environmental professional must provide a **Written Report** that details the findings of the Phase II ESA in relation to the Statement of Objectives.

The ultimate goal of a Phase II ESA is to determine if environmental cleanup of the property will be necessary.

If cleanup is not necessary or already completed, many states will issue a **"No Further Remediation Letter"** to remediation applicants.

This confirms that environmental conditions at their site no longer present a significant risk to human health and the environment.

The image on the right is of an old silo transfer station in Wisconsin.

The State Health Department conducted a site visit. They discovered an open trough that seemed hazardous.

The health department decided to come back and screen paint on metal tanks for lead and further investigate the trough.

The trough was later removed by the city.

These activities demonstrate partial Phase I and Two ESA activities.

We will now do a few knowledge checks.

Knowledge Check #3

Phase I ESA includes sampling soil and water on the site and testing the samples for contaminants.
A) True
B) False

Let's take 10 seconds to allow time to answer the question.

No Audio

Answer: B) False
Sampling is not conducted during a Phase I ESA. If sampling is needed, it takes place in Phase II.

Knowledge Check #4

Select all that apply: Phase I ESA typically includes the following:
A) Subsurface soil testing
B) Records searches
C) Site visit
D) Contamination evaluation
E) Underground storage tank sampling
F) Interviews

Let's take 10 seconds to allow time to answer the question.

No Audio

Answer: B, C, and F
These are typical of the Phase I investigation and research activities.

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

Let's take 10 seconds to allow time to answer the question.

No Audio

The answer is:
C) The Conceptual Model is the hypothesis for how target analytes may have arrived at or migrated through a site.

Now Huda and I will further discuss Phase I and II E-S-As.

The image on the right of the slide shows two students conducting Phase I ESA activities and learning about RECs: recognized environmental conditions.

Next, Huda and I will play an interactive game called, **What is the ESA Activity?**

Laurel: Hude the first prompt is, site visit.
Huda: What is Phase I ESA?
Laurel: Correct. The site visit occurs during the Phase I ESA.

Laurel: Next is, collect samples
Huda: What is Phase II ESA?
Laurel: Correct. Samples are collected during the Phase II ESA.

Huda: When does the Conceptual Model come into play?
Laurel: What is a Phase II ESA?
Huda: YES!! That is correct! For extra credit, what is it?
Laural Extra credit: The Conceptual Model is a hypothesis of how target analytes may have been released and migrated to, from, or in the site.
Very good!

Huda: Okay Laurel, in this activity, we interview owners.
Laurel: What is Phase I ESA?
Clearly, we are brilliant!

Let's make it a little harder. Laurel, I want you to... name that R-E-C! Okay, first prompt:

Huda: A pile of soil that is darker in one corner.
Laurel: That could be an oily spill!
Huda: Correct!

Laurel: OK Huda, you are next. There is an old building with peeling paint and a service station island.
Huda: That is possible lead-based paint!
Laurel: Anything else?

Follow-up: I would find out if the island has a tank or leaked petroleum under it.
Laurel: Excellent!

Laurel: Next, it is a clear, slightly breezy, sunny day. Huda, you are walking a site perimeter and across a site. What RECs might you notice?
Huda:

I would note any odor, such as something that smelled sweet, like a volatile organic compound.

I would also look for piles of trash in bags or otherwise. You never know what could be in there!

I would also look for waste left in place, such as drums or buckets.

Laurel: Congratulations! Brilliant, I tell you, just brilliant.

Now, Shereitte will describe the **Tiered Approach to Cleanup**.

Shereitte:
Thank you, Laurel!

Let's talk about more advanced site assessment and cleanup.

I will describe **risk-based, tiered approaches to cleanup**.

We use risk assumptions in each tier, refining them as we move up a tier.

Risk-Based Corrective Action is a way to evaluate risks to human health and the environment at different levels of exposure. It you helps to:

- Categorize sites according to risk
- Allocate resources for maximum protection of human health and the environment
- Provide appropriate levels of oversight
- Move all sites forward quickly

Tier 1: Environmental Impacts

Tier 1, Environmental Impacts, consists of a qualitative risk-assessment based on general site assessment information. At this stage, data identifies obvious environmental impacts, such as schools, homes, water bodies or people that may be more vulnerable such as children or the elderly.

Data also identifies significant exposure pathways, such as drinking water wells, or vapor transport. It is also important to note if there are people collecting or growing plants in gardens or fields.

Tier 2 uses more site-specific data to refine the appropriate risk-based actions, including:

Characterizing and monitoring contamination.

Projecting expected levels of contamination after treatment.

Identifying potential contaminant migration, often classed as a plume of contamination.

Using reasonable maximum exposure scenarios.

Tier 3: Site-Specific Risk Assessment

Tier 3 focuses completely on the site-specific conditions, such as fate and transport phenomena, as well as descriptions of the range of possible exposures and risks.

Site-specific risk assessment models may also be developed. Due to the costs involved, this analysis is suited to only large sites.

The goal of all tiers in the tiered approach to cleanup is to achieve similar levels of protection.

Let’s do a knowledge check.

Knowledge Check #6

Statement:
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

Answer: A) True

Evaluating Risks

Now we will move on to Evaluating Risks. The image on the right is of a "riskometer."

There are **involuntary risks** and **voluntary risks**.

- **Involuntary risks** are usually accidents such as accidental poisoning, foodborne illness, and fire-related fatalities.

- **Voluntary risks** are risks such as a motorcycle accident because you made the decision to ride a motorcycle or automobile. Working on a ladder or skydiving accidents are another two examples of voluntary risks.

If a land reuse site has been assessed for contamination—either through a Phase II ESA or by a state or federal regulatory agency—community members may have concerns about exposure to contamination.

Through the **ATSDR Partnership to Promote Local Efforts to Reduce Environmental Exposure (APPLETREE)**, ATSDR can fund state and tribal governments or organizations to conduct these activities at land reuse sites.

This link provides information about APPLETREE:

This link provides information about APPLETREE:
https://www.atsdr.cdc.gov/state-cooperative-agreements/php/about/index.html

As part of the public health assessment process, ATSDR and APPLETREE partners investigate and respond to harmful exposures in communities and educate the public about exposure protection.

In 2023, ATSDR funded thirty state health agencies.

Since 1988, ATSDR and their partners have completed nearly 3,000 health assessments at land reuse sites across the country—about 10% of which were brownfields.

ATSDR discovered health hazards at 42% of these brownfield sites.

During the health assessment process, either ATSDR or a state APPLETREE partner may review environmental data to determine potential adverse health effects on people who may live near or access a land reuse site.

Take a few minutes to watch the following video to understand how the health assessment process might work in a community:
https://www.youtube.com/watch?v=45Z82UzOc_c

After the video, Laurel will talk more about the public health assessment process.

Health Assessment Process Video:

Parent: So how was school today?
Child: Good.
Parent: You sure? No issues we have to talk about?
Child: No.
Parent: And your homework was fine?
Child: I didn't do it yet.
Parent: How come?
Child: I didn't have time to.
Parent: What's the first thing you'll do when you get home?
Child: I'll do my homework.
Parent: Okay, great. That's great.
Child: Can I have free time after?
Parent: After homework?
Child: Yeah.
Parent: Be careful.
Child: Okay.

Later in the video:

Child: Ugh, it smells.
Friend: I think it's coming from the creek.
Child: We should get out of here.
Friend: I agree.

Narrator: He's right. What he smells probably isn't good. It might even be chemicals from that old factory back there. Sometimes people do get exposed to chemicals in their environment. As you can imagine, hazardous chemicals can sometimes be harmful to people's health. And it takes a special group of people to figure out if those exposures are dangerous.

A special group of people like the **Agency for Toxic Substances and Disease Registry (ATSDR).**

Jennifer Freed (ATSDR):
Hi, I'm Jennifer Freed from ATSDR.
In the next few minutes, I'm going to introduce you to our agency.
I'll explain what our agency does in communities like yours.
Most importantly, I'll let you know what you can expect from ATSDR.

There's a good chance you've never even heard of ATSDR before.

ATSDR is a very small agency, part of the U.S. Centers for Disease Control and Prevention (CDC), ATSDR's headquarters is located in Atlanta, Georgia. But we also have staff in ten regions across the country.

We also have partnerships with many state health departments that help us address people's concerns about environmental exposures.

Now that you know our name and where we work, you might be wondering what we do.

In a nutshell, ATSDR's main job is to reduce your exposure to hazardous chemicals.

How do we do that? Come along and I'll show you.

ATSDR gets involved in communities where people might be exposed to hazardous chemicals in their environment.

It could be something in the water, the soil, the air, or even something that we eat.

Hazardous chemicals can be found both indoors and outdoors.

As it turns out, there might even be something hazardous in this creek right here. And it's ATSDR's job to find out if it could harm people's health.

One of the first things ATSDR does is visit the site.

Once we arrive in a community, our first step is to talk to people who are concerned about hazardous chemicals in their environment. This is usually done by someone we call a **health assessor**.

The next thing we look at is how people in a community might be exposed to hazardous chemicals in their environment.

For example, have Tommy and his friends ever played in the creek when there is a strong smell?

Once we know that people have been exposed to hazardous chemicals, we look at how that exposure might affect their health.

We do this by studying data. A lot of data.

In fact, that's what our health assessor is doing right now.

"That's right. Like you said, I'm in the process of studying the results of water samples collected from the creek to see if there's any chemicals in them and if so, how much. It's basically what ATSDR does."

Most times, an ATSDR health assessor studies the data from samples taken in air, water, and soil in the community to see if people have had contact with unhealthy amounts of hazardous chemicals.

It's important to remember that ATSDR analyzes the data, but they don't collect the samples themselves.

In most cases, either EPA or some other health agency will collect them.

Sometimes there isn't enough data to make a call on. In that case, we might not be able to determine if hazardous exposures are occurring.

It's also important to remember that studying the data from samples of air, water, and soil takes time. It doesn't happen overnight.

It can take a few weeks or even months to really analyze the data so that we provide the very best information about whether people are being exposed to hazardous chemicals.

Follow-up conversation:

"So it's been a while since our health assessors started studying the data of samples of creek water. Let's catch up with him to see what he's found."

"Hello?"
"Hello."
"So, what did you learn from the data?"
"Well, we learned that there's some low levels of hazardous chemicals in the creek. They're high enough to cause odors in the community, but not high enough to pose any harm."
"So there's no health hazard at the site?"
"That's correct."
"Okay. Thank you."
"You're welcome."

So the health assessors studied the data and came to the conclusion that the amount of chemicals in the creek was not high enough to cause any harm to people's health.

And that's exactly what the health assessor is going to write in his report.

Which brings us to the next step in the ATSDR process.

After the health assessor has studied all the data, they usually write up a report that explains what they found and what it means.

They may also make recommendations to the community and other health agencies about how they can reduce exposures to hazardous chemicals in the community.

Once the health assessor has completed their report, they will talk to the community to explain what they found and what those findings mean.

They will also answer any questions the community may have about the report.

And this is done at a community meeting.

ATSDR works very hard to answer any questions you might have about our reports.

We want to make sure communities like yours understand everything they need to know about hazardous chemicals in their environment.

So that's basically it.

You have seen how our job is to help protect your community from exposures to hazardous chemicals.

We have been doing this for over 30 years in communities all across the United States.

ATSDR is looking forward to working with your community.

If you have any questions about ATSDR, please do not hesitate to ask your health assessor or call 1-800-CDC-INFO.

Thanks for joining us.

Laurel:

ATSDR and our APPLETREE partners:

- Identify exposure pathways at specific waste sites, such as the risk of inhaling or touching a chemical contaminant.
- We evaluate environmental and health data to identify potential health risks.
- We recommend ways to stop or reduce exposures. That is one of the most important things we can do.

- We ask how can we stop or reduce exposures now until a site can be cleaned up? This can greatly help to reassure a concerned community.

For example, we may recommend removing shoes before entering the home or adding mulch or vegetation to soil to reduce exposure to lead in soil.

This is a map of the public health assessments (PHA) and the health consultation database maintained by ATSDR.

You can find health assessments and health consultations done in your state at: https://www.atsdr.cdc.gov/state-cooperative-agreements/map/index.html

ATSDR incorporates elements of risk assessment into its public health assessment process.

The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced.

ATSDR public health assessments evaluate:

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

Addressing the community's concerns is a key activity in our PHA process.

We report our findings in either a **public health assessment** or a **public health consultation**.

The main difference between the two is:

- A **health consultation** typically looks at one exposure pathway, such as groundwater
- Whereas a **public health assessment** typically looks at more than one exposure pathway such as soil and air.

Anyone can petition ATSDR to investigate a waste site or a suspected waste site.

Residents, agencies, and others can petition ATSDR for a public health assessment or health consultation to investigate:

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

Because we're not a regulatory agency, ATSDR **cannot**:

- Change how a facility operates
- Can't clean up chemicals in your community
- Can't make medical diagnoses for individuals (although we may provide summary statements about health in an impacted community)
- Make health conclusions without environmental or biologic population data
- Change zoning codes
- Make another organization treat you with fairness and respect

Here is the link for more details regarding The ATSDR Petition process:
https://www.atsdr.cdc.gov/programs/atsdr-petition-program.html

Public Health Assessment Training (PHAT)

Public Health Assessment Training (PHAT) or PHAT provides the basic skills to conduct a public health assessment (PHA).

PHAT consists of **eight modules** based on a realistic environmental case study and includes:

- Problem-solving exercises

- A comprehensive list of resources explaining how to conduct PHAs

We encourage learners to progressively complete all eight modules. However, you might decide to study only those that you need.

Here is the link to the ATSDR Health Assessor Training:
https://www.atsdr.cdc.gov/pha-training/php/training/index.html

- **Modules 1–3**: You will learn what ATSDR is, its PHA method, and how to gather and document site information and data.

- **Module 4**: You will learn to evaluate the exposure pathways for contaminants at hazardous waste sites.

Public Health Assessment Training (PHAT) – Continued

- **Module 5**: You will study how to select sampling data that are appropriate for the PHA.

- **Module 6**: You will learn the basics of the screening analysis used in the PHA process.

- **Module 7**: You will learn how to conduct a health effects evaluation to closely examine potential contaminants of concern.

- **Module 8**: You will learn how to write and communicate environmental health information in clear language.

Comparing Risk Assessment and Public Health Assessment

Let's compare risk assessment and public health assessment.

- **Quantitative risk assessment** provides a numeric estimate of theoretical risk or hazard, assuming no cleanup takes place.

- **EPA** uses this method to make decisions about cleanup.

- EPA's risk assessments look at current and future exposures and consider all contaminated media, whether exposures are occurring or are likely to occur.

- By design, it generally use standard or default protective exposure assumptions such as body weight, soil ingestion rates, or drinking water intake rates when evaluating the risk to human health from exposure to contaminants at a hazardous waste site.

ATSDR's **public health assessment** process uses similar risk assessment methods, but our goals are different.

- ATSDR works closely with communities to identify and answer their health concerns.

- When feasible, our documents will review and describe health outcome data.

- We also evaluate all pathways of exposure to determine if the public might experience harmful effects from exposure to site contaminants and we describe those effects in our documents by looking at past, current, and future exposures.

- We then recommend ways that agencies and the public can reduce or stop exposure to site contaminants by developing a public health action plan.

The general steps in the two processes are similar in terms of data gathering, exposure assessment, and hazard evaluation.

But the **public health assessment** provides additional public health perspective by integrating site-specific exposure conditions with health effects information and addresses specific community health concerns.

To learn more about the public health assessment process, you can view this webinar at one of the links below:
atsdr.cdc.gov/videos/pha-webinar/Introduction-to-ATSDR-and-the-PHA-Process-low-res.mp4

We will now complete a knowledge check.

Knowledge Check #7

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

A) True
B) False

Let’s take 10 seconds to allow time to answer.

No Audio

Answer: A) True

Next, our guest lecturer Kai will present a case example. Welcome Kai!

Kai:

Hello, I'm Kai.

This is a site I led as an ATSDR APPLETREE health assessor back in 2007 when I worked at Idaho’s Department of Health & Welfare’s Bureau of Community & Environmental Health.

I worked with ATSDR from 2013 to 2024 and served as a Regional Director in the Office of Community Health Hazard Assessment.

- Methamphetamine, or meth lab busts in Idaho reached a peak in the early 2000s.
- Contamination as a result of drug use remains a frequent issue.
- Identifying and cleaning up properties depends mostly on current owner reporting the contaminated property to the state.
- The Idaho Department of Environmental Quality (IDEQ) cannot act until local law enforcement officially reports a lab.

Case Site: Immanuel Methodist Episcopal Church – Boise, Idaho

Our activities at the church shown in the image on the slide, the Immanuel Methodist Episcopal church, occurred when I was with the state health department, prior to joining ATSDR. At that time, I worked closely with colleagues from local, state, and federal agencies.

This site is located in Boise, Idaho. Boise, as shown in the figure, is in the far Southwest corner of the state.

Images:

- In the image on the left, the former Immanuel Methodist Episcopal church exterior is shown.
- On the right, the image shows a former meth lab inside the church.

Community Transformation:

For most communities, the presence of a local abandoned church-turned-meth-lab does not spark the notion of a future hub for children's learning, well-being, and artistic growth. However, for one community in Idaho's capital city, that is precisely what is emerging. A vision of what could be became a reality with the combined efforts of a determined organizer, health officials, engineers, designers, architects, and a host of volunteers young and old. This case study shows how a community is persevering even in light of funding challenges.

Historical Note:

- Built in 1907 and listed in the National Register of Historic Places, Immanuel Methodist Episcopal Church in Boise does not seem like a likely candidate for being a brownfields site.
- Despite being a fixture of the quaint Hyde Park neighborhood for the better part of the 20th century, the church congregation began shrinking in the 1970s when another local Methodist church opened its doors.

By the end of the decade, the property was sold to a private owner who intended to convert the building into apartment units. That plan, however, never happened.

In the decades following, the former church changed hands again and ultimately fell into disrepair due to general neglect and insufficient maintenance.

The empty building had been so ignored that by the 1990s the church had become a haven for methamphetamine use and production. The so-called "meth lab" was subject to multiple searches, seizures, and arrests as a result of meth production and meth use. In addition to being a highly addictive and harmful drug on its own, typical production of methamphetamine creates

toxic, explosive, and flammable byproducts and leaves behind harmful meth residue. The result was that, by 2007, the church was found to be contaminated with toxic materials including lead paint, methamphetamine, and suspected asbestos.

The empty building had been so ignored that by the 1990s the church had become a haven for methamphetamine use and production. The so-called “meth lab” was subject to multiple searches, seizures, and arrests as a result of meth production and meth use. In addition to being a highly addictive and harmful drug on its own, typical production of methamphetamine creates toxic, explosive, and flammable byproducts and leaves behind harmful meth residue. The result was that, by 2007, the church was found to be contaminated with toxic materials including lead paint, methamphetamine, and suspected asbestos.

Users go days without sleeping and often become violent. Withdrawal effects for chronic users can include depression and excessive eating and sleeping. Its addictive nature, the dangers of its production and use, and the crime associated with its distribution make the presence of meth a major community risk.

Meth’s toxicity thresholds are well documented in scientific literature. The effects from different doses and exposure pathways give toxicologists a good idea of how harmful a contaminated site might be.

Now let’s talk about how the community transformed this former church turned meth house.

Community Transformation

As founder and director of the educational dance initiative *Dance Rascals*, the new owner has experience in building children-focused educational programs involving the arts.

Dance Rascals, founded in 1996, grew quickly and soon became the Children’s Dance Institute in Boise. The Institute’s programs enjoyed a reputation for fun, empowering, and educational experiences for young children of preschool to elementary school ages. Yet the owner’s vision for an expanded arts facility for children had yet to find a home. As a resident of North End, he kept thinking about the enormous potential of the old rundown church.

After two years, the previous owner of Immanuel Church agreed to sell the derelict building. The owner of the dance studio made a low offer, and the owner, whose own kids had been students at the Children’s Dance Institute, accepted the price at hundreds of thousands below

other potential offers. The newly acquired building would serve as a new base for TrICA's even broader educational initiative under its newest name, Treasure Valley Institute for Children's Arts (TrICA). The 18,000 square-foot facility would not only provide the dance spaces that were at the core of the successful dance program, but allow for an expansion of classes, including music, culinary, and visual arts.

The move by TrICA signaled an important shift in the fate of the building. In 2003, Preservation Idaho, the Idaho historic preservation council, had placed Immanuel Church on its list of threatened and endangered historic places in the state. The planned renovation of the church would bring much-needed repair to a blighted building in an otherwise desirable residential neighborhood. Thus, TrICA's future home would give a boost to the lives of local children, as well as help restore the neighborhood's commitment to historic preservation and community health.

Environmental and Health Risk Evaluation

To evaluate environmental and health risks, there were many concerns. The building had a history of drug-related arrests and a visibly worn-out structure. The building was on the National Register of Historic Places; however, it showed signs of having likely health hazards. In September 2007, just three months after the purchase by a nonprofit, Idaho's Department of Health & Welfare walked through the property to assess possible hazards to those who had volunteered to clean up the building and to office staff in the building. Leaders at TrICA were concerned that weekend volunteers and the two full-time employees at the site were being exposed to a harmful, or at least risky, environment. What the state health officials found raised red flags for both structural safety and human health.

Past methamphetamine use led to several contaminated areas within the building, such as kitchen appliances, where meth had been "cooked." Other areas where addicts had used the drug also showed evidence of the toxic substance. In addition, the ventilation system from the kitchen to elsewhere in the church had residual methamphetamine. Even portions of insulation that were exposed to the ventilation system had high amounts of the drug itself. Certain parts of the building had meth concentrations up to 138 micrograms per 100 square centimeters. That is more than a thousand times the cleanup standard for the State of Idaho.

The contamination issues, however, did not end there. Sampling revealed the presence of lead paint – both inside along walls and floors and outside in the soil. Lead concentrations on the basement floor were nearly six times the EPA clearance standard for interior floor surfaces in public housing. The discovery of lead contamination in particular played a critical role in

procuring funds for remediation. The health team also identified floor tiles that were suspected of containing asbestos, a hazardous mineral once widely used inside buildings. After analysis, asbestos in the floor tile was not found.

This site was an endangered historic site. The proposed site reuse was extreme. It would go from housing people addicted to meth to teaching small kids.

There were proactive efforts to assess health concerns. TrICA directly sought the counsel of the state's Department of Health and Welfare, Bureau of Community & Environmental Health, to make sure everyone had a clear picture of the condition of the building.

The bureau, under Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, was charged with evaluating the potential for harmful exposures associated with environmental contamination. TrICA also contacted the state brownfields program and inquired about environmental sampling available through that program. Based on sampling results for lead, asbestos, and methamphetamine, the health team examined possible exposures within the building and researched the possible impact of those exposures. Though "no national guidelines [exist] for evaluating health effects from exposure to materials in homes or buildings where methamphetamine has been smoked or manufactured," the team utilized the scientific literature to help assess potential hazards.

The good news was the conclusion that possible past exposures of volunteers and other workers in the building were not likely harmful. Still, they emphasized the importance of removing the residual lead and methamphetamine contamination to protect the health of the children and staff slated to use the building. TrICA secured funding for environmental sampling and ATSDR completed a health consultation.

Resources for the TrICA brownfields site include:

- The TrICA website at: TrICA website: https://www.trica.org
- Idaho Department of Environmental Quality Brownfields Response Program at: Idaho DEQ Brownfields Program: https://www.deq.idaho.gov/

Environmental Risk Data

In evaluating the environmental and health risks of the site, a contractor was funded by Idaho Dept. of Environmental Quality or DEQ.

The contractor found Surface meth residues were as high as 138 micrograms per 100 square centimeters though mostly in out-of-reach areas. (Idaho's Clearance Standard is zero point one microgram per 100 square centimeters.)

Lead loading was as high as 283 micrograms per square foot (U.S. Department of Housing and Urban Development, or H U D, windowsill clearance is 100 micrograms per square foot).

Volunteer labor and office staff at the site meant there were special concerns.

Images:

- The map on the right shows different samples taken at Immanuel Methodist Episcopal Church.
- The top left image shows me, Kai Elgethun, taking a sample.
- The bottom left image shows a windowsill covered with methamphetamine residue.

Health Consultation

In addition to a site assessment, ATSDR produced a Letter Health Consultation. This is available at:

https://www.atsdr.cdc.gov/hac/pha/TricaImmanuelChurch/TRICA%20-%20ImmanuelChurch%20LHC%205-7-2008.pdf

The non-profit office had to stay onsite to minimize exposures and behavior changes.

The Idaho Bureau of Community and Environmental Health provided multimedia outreach to volunteers and employees. They also provided a toll-free line with email support.

In October 2009, the nonprofit owner consulted Idaho Bureau of Community & Environmental Health regarding contamination clearance levels since they needed to host a fundraiser with a well-known dancer. The Idaho Bureau of Community & Environmental Health gave the go-ahead for specific activities and areas of the building.

At the request of Idaho D-E-Q and the contractor, Idaho Bureau of Community & Environmental Health reviewed final cleanup activities, clearance levels, and safety issues.

APPLETREE Program Benefits

ATSDR's APPLETREE cooperative agreement program with the state was a benefit to agencies and partners in land reuse.

It facilitated:

- No-cost health assessment and materials development with integration with the state D-E-Q.
- Rapid response and reduced human exposure during redevelopment.
- Ongoing outreach and support to public.
- This was accomplished by a multi-media outreach approach and transparency.

Project Outcomes

The outcomes of the project included preventing significant meth and lead exposures of workers and the public and saving and refurbishing an historic landmark. In addition, drug-related crime was stopped at this location. Ultimately, the non-profit drew the community together.

This project represents Step 4 of ATSDR's 5-step Model:

Redesign with Health in Mind. To learn more about health-focused redevelopment, take Module 4 of the EHLR training.

To learn more about health-focused redevelopment, take **Module 4** of the EHLR training.

The three images show the previous Immanuel Church transformed into the **Treasure Valley Institute for Children's Arts (TrICA)**.

This image shows kids performing at TrICA.

The image shown is the inside of TrICA after its complete renovation.

Lessons Learned

- In 2007, brownfields grants did **not** provide funds for just methamphetamine contamination.

- TrICA would not have received financial support from the state Brownfields Response Program had there not been **lead paint contamination**.

- There are **no federal standards** for methamphetamine contamination, and not all federal remediation funding supports meth cleanup.

- This detail is important for more recent blighted lands that may not have common contaminants like lead or asbestos, but still may have suffered the ill effects of drug contamination.

Key Takeaways:

- Assessing health hazards early in the process is critical to protecting the safety of building dwellers.
- Understanding the nature and extent of contamination and possible hazards to human health is a critical piece of any development plan.
- Involving public health specialists early in a project helps identify any imminent health hazards or possible hidden hazards.

Brownfields Funding Benefits

Brownfields funding can have peripheral benefits. The grants and loans provided to TrICA worked toward repairing structural damage.

If a property is structurally unsound, it is possible that brownfields grants will provide for remodeling prior to remediation. In this case, removing meth and lead damage along with physical hazards and instability in the structure was possible.

This possibility might be a suitable alternative to total demolition and then starting from scratch. It saved a beautiful old historic landmark and provided a community gathering space and children's dance hub.

Resources for More Information

Treasure Valley Institute for Children's Arts (TrICA)
The TrICA Web page describes its artistic programs and vision for the future. The main page of the web page also features a short video documentary highlighting the organization and its current status at Immanuel Church.

It is available at: http://www.trica.org/

Idaho Department of Environmental Quality (IDEQ) Brownfields Response Program
As the principal state environmental regulatory agency in Idaho, IDEQ is responsible for providing part of the grant money that TrICA used to pay down borrowed money from the revolving loan fund.

For more information, see: https://www.deq.idaho.gov/

Idaho Department of Health and Welfare – Bureau of Community & Environmental Health
The Idaho Department of Health and Welfare Bureau of Community & Environmental Health conducts site assessments and environmental education for communities through its environmental health section. As the state counterpart to ATSDR, the bureau's environmental health section works with I-D-E-Q and EPA to tackle many of the hazardous waste sites in Idaho.

For more information, access: https://healthandwelfare.idaho.gov/health-wellness/environmental-health

Tools and Resources for Environmental and Public Health Assessments

Thank you, Kye, for that very informative presentation. We will end this module with a discussion of the tools and resources available to inform and assist your Environmental Site Assessments and Public Health Assessments.

First, there is the ATSDR National Land Reuse Program, which you accessed to take this training. The Land Reuse Program provides a variety of tools and resources.

Next, we have ATSDR's Toxicological Profiles: Toxicological Profiles or Tox Profiles are a unique compilation of toxicological information on a given hazardous substance.

Each peer-reviewed Tox Profile reflects a comprehensive and extensive evaluation, summary, and interpretation of available toxicological and epidemiological information on a substance.

Tox FAQs are summaries about hazardous substances using excerpts taken from the ATSDR Toxicological Profiles.

Resources are available by audience: Community members, emergency responders, toxicological and health professionals, and health care providers.

You can access tox profiles with access to Tox FAQs at the Toxic Substances Portal link: https://wwwn.cdc.gov/TSP/index.aspx

Continuing Education

- There is an open book post-test and continuing education units are available.
- The test is optional but needed to obtain the continuing education units.
- See instructions on the training home page to link directly to CDC TRAIN to take the post-test.

Conclusion

That is the end of the presentation for **Module 2**.

On behalf of the **EHLR Instructional Team** and guest presenter **Kai Elgethun**, thank you for attending.

For more information, you can email the land reuse team at: atsdr.landreuse@cdc.gov