Module 9: SI Strategies: Soil Exposure and Air Migration Pathways

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9-1

SI Strategies Soil Exposure Pathway

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Objectives for Soil Exposure Pathway Sampling

- **Participants will be able to devise and evaluate soil exposure pathway sampling strategies that:**
  - » Demonstrate observed contamination
  - » Establish level of contamination
  - » Demonstrate attribution of contamination to the site
  - » Identify all targets and establish distances from contamination
  - » Appropriately infer contamination
- **Case study example**

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Overall Sampling Strategy or Design Considerations

- **Primary objectives**
  - » Assess if targets are on AOCs
  - » Evaluate how likely it is that targets will travel to AOCs
- **Design considerations**
  - » Likelihood of exposure
  - » Waste characteristics
  - » Targets

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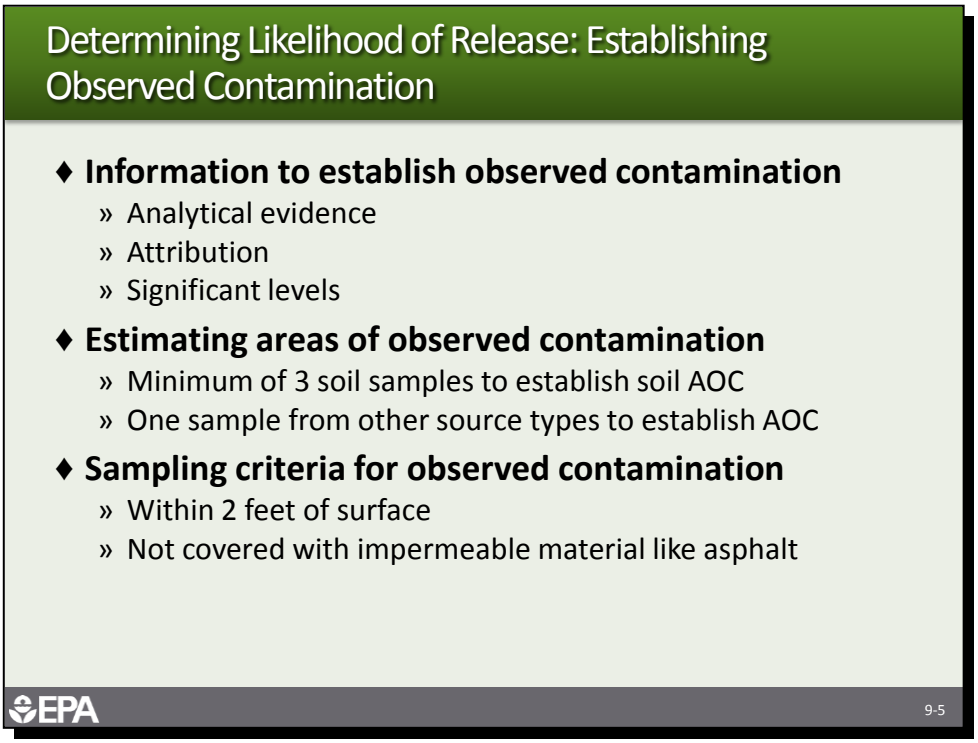
Notes

- **Primary objectives:** The primary objective of soil exposure sampling is to identify whether residential, school, daycare or work place properties are contaminated. The soil exposure pathway evaluates the likelihood that targets exist on areas of contamination or that targets will travel to those areas, and not the likelihood that hazardous substances will be released and migrate to targets.
- **Design considerations:** Analytical evidence should demonstrate whether the hazardous substance is attributable to the site and is present at a concentration significantly above background levels.
  - » **Likelihood of exposure:** A likelihood of exposure value is assigned if an area of observed contamination is located on the same property and within 200 feet of a residence, a school or daycare center, or a workplace area, or if an area of observed contamination is within the boundaries of a resource or a terrestrial sensitive environment.
  - » **Waste characteristics:** Waste characteristics factors are toxicity and hazardous waste quantity. Areas of observed contamination are evaluated rather than sources for hazardous waste quantity in the soil exposure pathway.
  - » **Targets:** Targets include a resident population threat (including residences, schools, daycares, work places, sensitive environments and resources) and nearby populations within 1 mile.

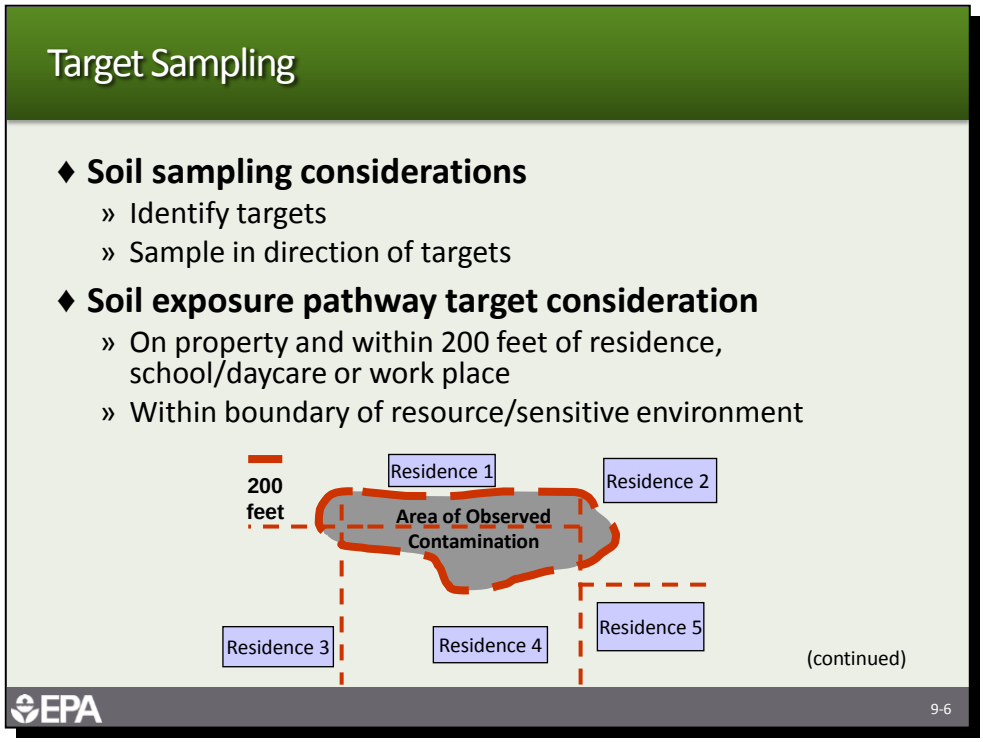


Notes

- **Information to establish observed contamination:** There must be analytical evidence of data and analytical evidence that demonstrate attribution and contamination present at significant levels to establish observed contamination. Observed contamination by direct observation cannot be used for this pathway, which is why analytical data are needed. If observed contamination cannot be established, do not evaluate this pathway.

- **Estimating areas of observed contamination:** Sampling to identify resident population targets should occur, and a minimum of three soil samples should be collected to estimate areas of observed contamination. One sample from the other source types can be used to demonstrate that the whole source type is an area of observed contamination.

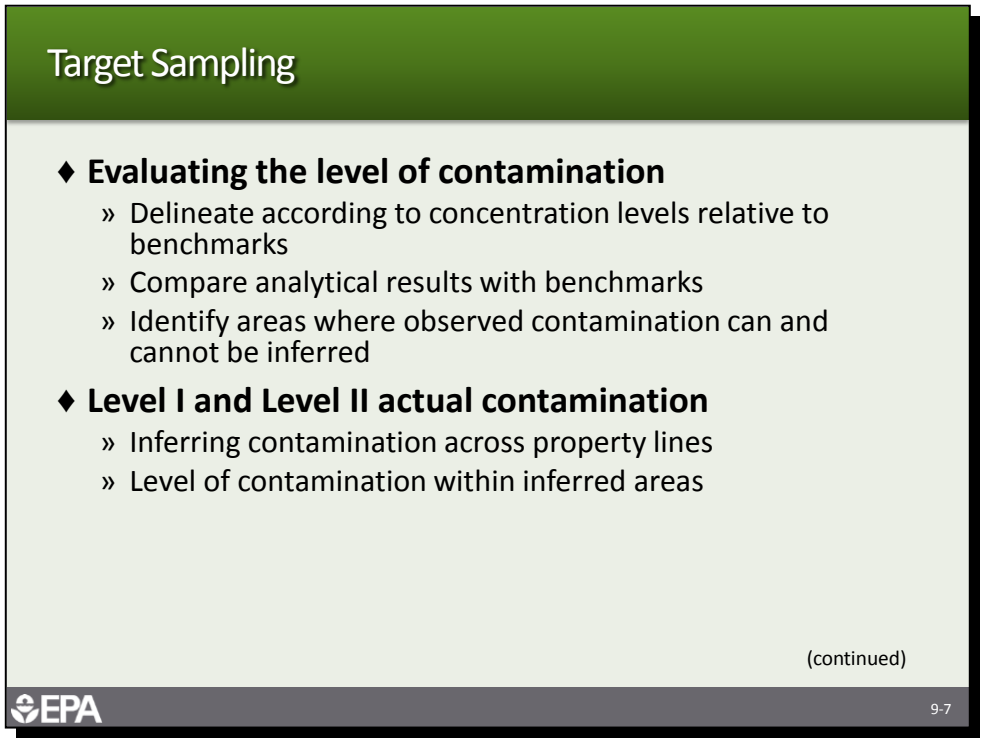
- **Sampling criteria for observed contamination:** Samples should be collected within 2 feet of the surface. No impenetrable material such as asphalt or concrete should be present above the sample location. Most surface samples will be soil, but some could be leachate, source material, sediment from overland runoff drainage ditches or other surficial materials.



Notes

- **Soil sampling considerations:** Considerations for soil sampling include sampling to identify targets exposed to surficial soil contamination and sampling in the direction of targets only. Sample locations should document any observed contamination within the property boundaries of a residence, school, daycare center, or workplace or within the boundaries of a terrestrial sensitive environment or resource. Document observed contamination at concentrations significantly above background levels and attributable to the site. Delineate areas of surficial contamination at the site and identify the level of contamination within these areas. The investigator should identify and sample routes that may transport hazardous substances by air or water. The most important analytical data for the soil exposure pathway are samples that establish observed contamination and level of contamination.

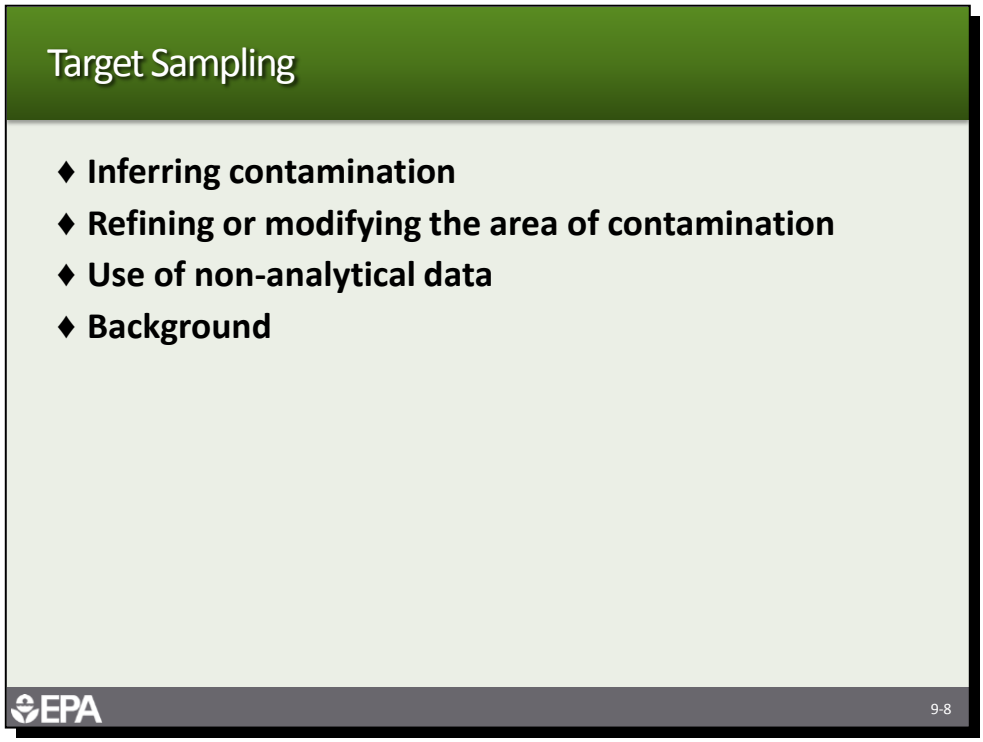
- **Soil exposure pathway target considerations:** It is important to consider targets for the soil exposure pathway by demonstrating contamination on property and within 200 feet of the residence, school or workplace, and demonstrating contamination within the boundary of a resource or sensitive environment.



Notes

- **Evaluating the level of contamination:** The level of contamination is evaluated for each residential, daycare, school or work place property. For HRS scoring, contamination can be inferred between two points of observed contamination based on site conditions. Each area of observed contamination should be delineated by comparing the concentration levels of contaminants with benchmarks. Soil benchmarks are listed in the SCDM. Contamination can also be inferred between two sampling points.

- **Level I and II actual contamination:** When the concentration of contaminants in the observed area of contamination equals or exceeds benchmarks, then Level I actual contamination is established. When the concentration of contaminants is below benchmarks but is greater than 3 times background concentrations, then Level II contamination is established. Inferred contamination is also evaluated as Level II contamination.



Notes

- **Inferring contamination:** Contamination can be inferred for HRS scoring. However, the population associated with the areas of inferred contamination is evaluated as Level II resident threat targets. The investigator should identify areas where observed contamination can and cannot be inferred. Contamination can be inferred between two points of observed contamination based on site conditions.

- **Refining or modifying the area of contamination:** If samples that do not meet the criteria for observed contamination are collected from within an area of inferred contamination, the investigator should evaluate whether the area of contamination needs to be refined or modified. An example is a site where liquid wastes containing hazardous substances were spilled. Areas of higher elevation than the spill generally should be excluded from the area of inferred contamination, even if they are within the originally inferred area.

- **Use of non-analytical data:** For decision making, non-analytical data can be used to infer or corroborate the area of observed contamination. Corroborative information may include data derived from other investigations; documented historical waste deposition patterns; patterns of distressed vegetation; infrared satellite imagery that indicates anomalies in soil; and topography and drainage patterns.

- **Background:** Background samples generally should represent the uncontaminated area around the site. Background samples should be collected from undisturbed areas if the site is located near areas filled in with soils from different sources. However, the background sample should come from the fill if the site is located in fill material. Background samples should not be collected from drainage channels because they are likely to be influenced by surface water runoff from areas other than the site. Background and observed contamination samples should be collected within 1 to 3 days of each other.

Soil Sampling Strategies

Criteria	SI Data Collection
Primary ojectives	Document target exposure to hazardous substances related to site sources
Data quality	Rigorous depending on objectives
Avg # of samples	1 to 20 based on documentation requirements and number of sources and targets
Types of activities	Sample source and target areas indicating possible surficial contamination Sample resident targets not yet sampled Collect multiple samples from properties where concentrations are near benchmarks
Background samples	As many as necessary, research natural soil concentrations in area; use aerial photographs
Attribution samples	Those necessary for attribution
QA/QC samples	Minimum 1 split/ 1 blank/1 duplicate per regional guidelines

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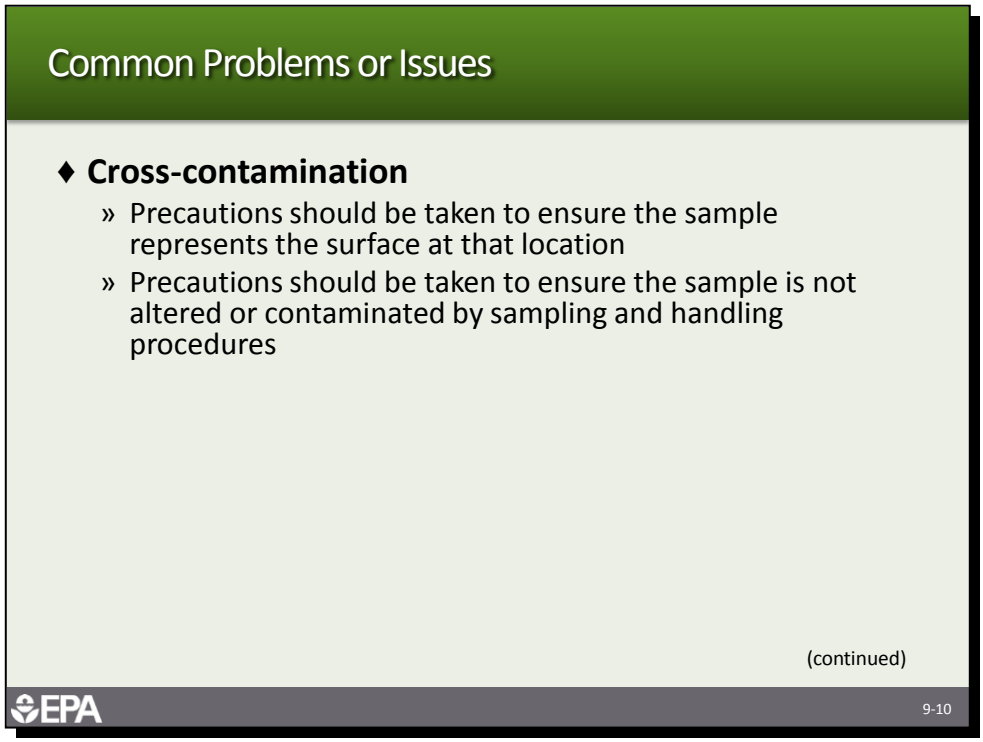
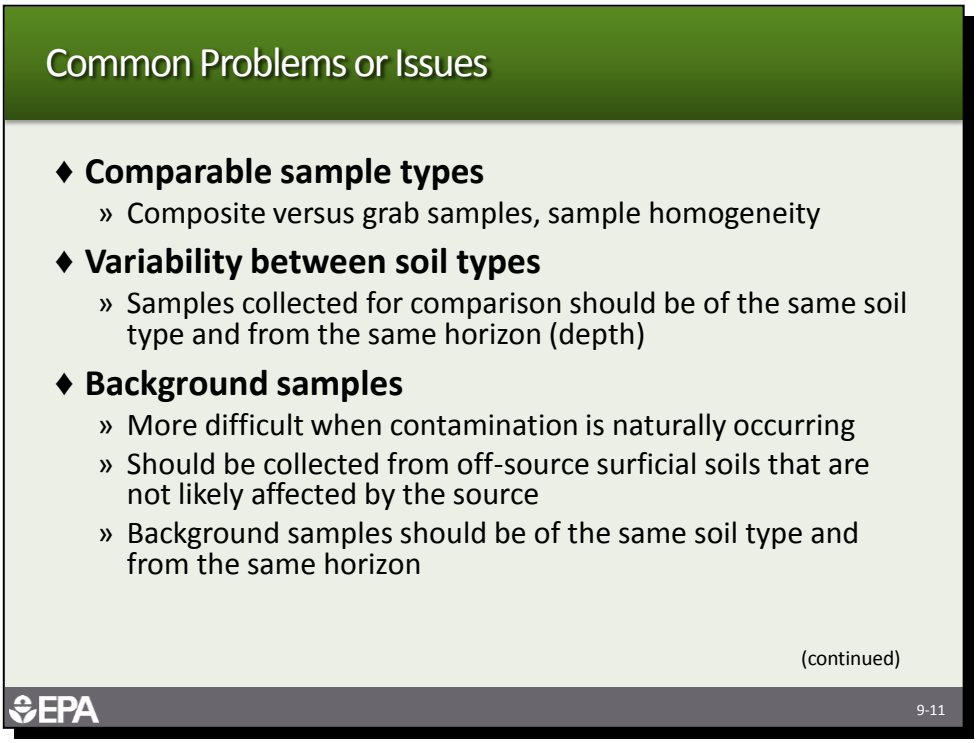


Notes

◆ **Cross-contamination:** When collecting, handling and packaging samples, great care must be taken to ensure the sample represents the surface at that location and that samples are not altered or contaminated by improper sampling or handling procedures.

Cross-contamination potential can be greatly reduced by using disposable sampling equipment (such as plastic scoops) when possible. This avoids the need to decontaminate sampling equipment between sampling locations.



Notes

- **Comparable sample types:** Soil samples should be of comparable type. Composite samples should be compared with other composite samples and grab samples should be compared with other grab samples. Samples should also be homogenous as possible.

- **Variability between soil types:** Soils should be similar in texture, color and grain size for analysis of metals and for background and observed contamination. Considerable variability may occur between soil types as well as within a single soil type because of grain size, mineralogy, composition, soil horizons and lateral heterogeneity.

- **Background samples:** Off-site samples should also be collected for background samples. Results from other nearby site investigations can also be used to establish background. Literature values can also be used.

Common Problems or Issues

- **Background samples are not needed for sources (except contaminated soil), but can be used to show increase in on-site contamination especially when contaminants are naturally occurring**

HIGHLIGHT 9-1
BACKGROUND SAMPLES FOR AREAS OF OBSERVED CONTAMINATION

SOURCE	Background Sample
Contaminated Soil	Soil in vicinity of the site. See Sections 5.1 and 5.2 for additional considerations.
Tanks/Drums Filled with Contaminated Soil	Same as for the soil at the site.
Tanks/Drums Containing Liquid or Solid Wastes	Background is zero.
Landfill[a]	Soil in vicinity of the site.
Piles[a]	Soil in vicinity of the site.
Surface Impoundment[a] (liquid)	Aqueous samples from vicinity of the site. Background may be zero.
Surface Impoundment[a] (sludges or backfilled)	Soil in the vicinity of the site.
Other Sources	review on a site-specific basis

[a] For these source types, the indicated sample is likely to be the most appropriate background.

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Notes

- Background samples are not needed for sources or areas of observed contamination, however, they can be used to show an increase in contamination especially when contaminants are naturally occurring. HRS Guidance Manual 9-1 provides a list of background samples that can be used for areas of observed contamination.

Case Study Example
Carbeth Landing Site – PA Findings

- **The Carbeth Landing Site is a dump near a residential neighborhood and elementary school**
- **Dumping occurred for an unknown period**
  - » Allegedly included paints, organic and inorganic substances, and construction debris
- **The area is devoid of vegetation**
- **Sources at the site include:**
  - » Several 5-gallon containers
  - » Two poorly defined areas of stained soils

(continued)

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Case Study Example
Carbeth Landing Site – PA Findings

- **Pigeon River, which flows at 1,600 cubic feet per second and is located 400 feet east of the site, flooded the site twice in the past 7 years**
- **The PA concluded that flooding may have carried hazardous substances onto adjacent school and residential properties**
- **Hazardous substances associated with the site are not known, but could involve metals typically found in paints**

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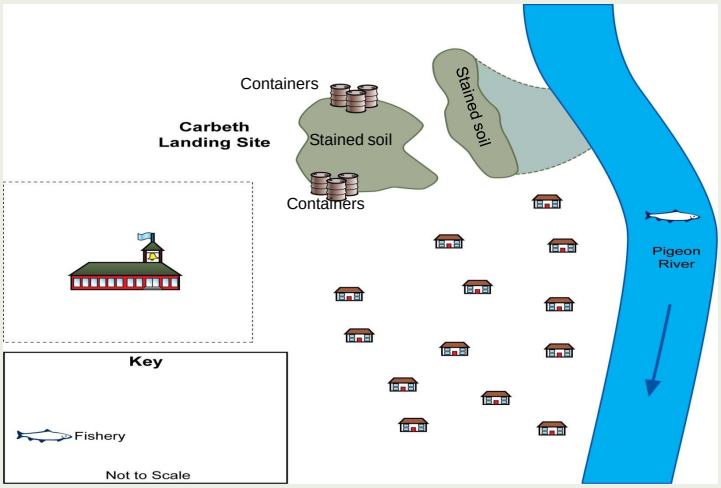
Carbeth Landing Site Map



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Phase I
Focused SI Soil Sampling Strategy

Samples	Approach	Rationale	Non-sampling Data
Residential soil samples	Determine if nearby residential properties (SS-11, -12, and -13) and the school yard (SS-9 and SS-10) are targets	Investigate population exposure to hazardous substances	Determine number of people per residence, number of students attending school, and number of teacher and staff working at school
Background soil (SS-7 and SS-8)	Limited	Determine levels of hazardous substances and define effects of flooding	Obtain historical aerial photos and FEMA maps Research natural background levels of metals
Sources (SS-1 through SS-6)	Identify hazardous substances present at the site; sample to test hypothesis of surficial contamination	Do not sample to increase waste quantity because amounts not close to break points	Estimate physical dimensions of stained soil; count paint pails and look for drum labels
Quality control (Q-1 through Q-3)	Monitor sample collection and decon procedures; 1 rinsate, 1 duplicate, and 1 trip blank	Quality control samples help ensure that data is of good quality; duplicates measure field and laboratory precision	

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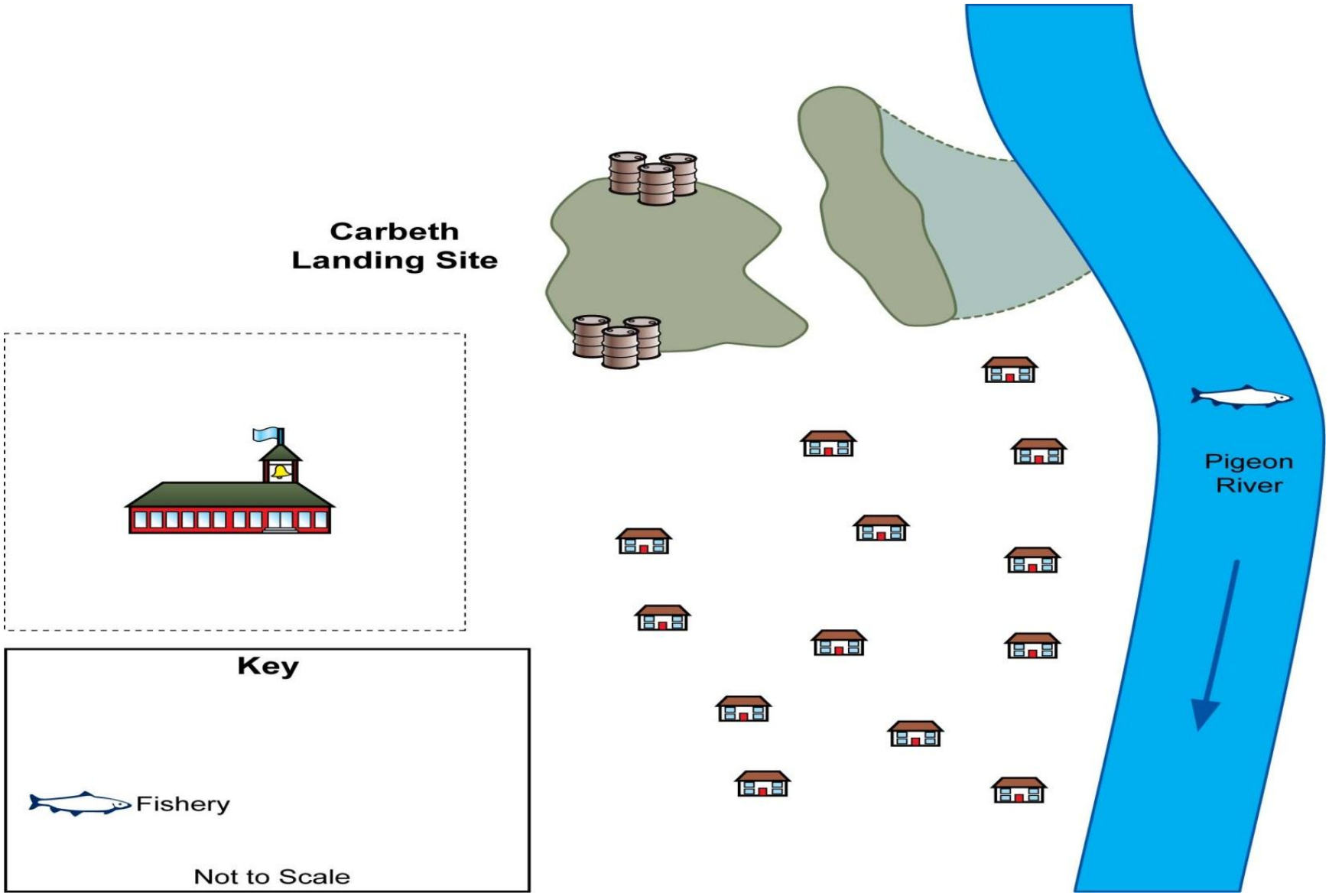
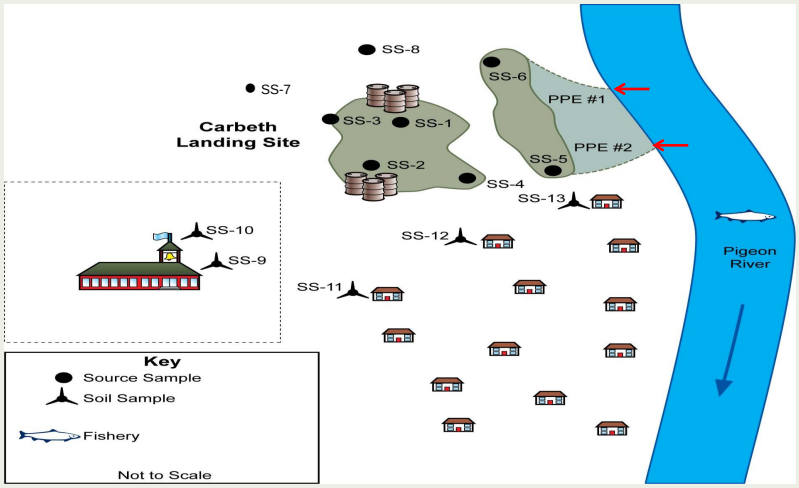

Carbeth
Landing Site
Pigeon
River
Key
Fishery
Not to Scale

Carbeth Landing Site
Focused SI Sampling Locations



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Phase II
Expanded SI Soil Sampling Strategy

Samples	Approach	Rationale	Non-sampling Data
Residential soil samples (XS-7, XS-8, XS-9, XS-11 through XS-17	Document resident targets and levels of actual contamination	Establish observed contamination on residential and school properties, target samples must be 3 or more times the background levels	Determine number of residents, property boundaries, number of students, and number of teachers and staff at school
Background soil (XS-3 through XS-6 and XS-10)	Sample area less influenced by site; document contamination attributable to site	Show that target contamination is attributable to site, rather than other sources of lead; ensure sufficient background samples for HRS	
Quality control (Q-1 through Q-6)	Monitor sample collection and decon procedures; transport and handling procedures; 2 equipment rinsates, 2 duplicates, 1 field blank, 1 replicate	Ensure sufficient QA/QC samples for HRS, ensure data is of good quality, monitor field and laboratory precision	

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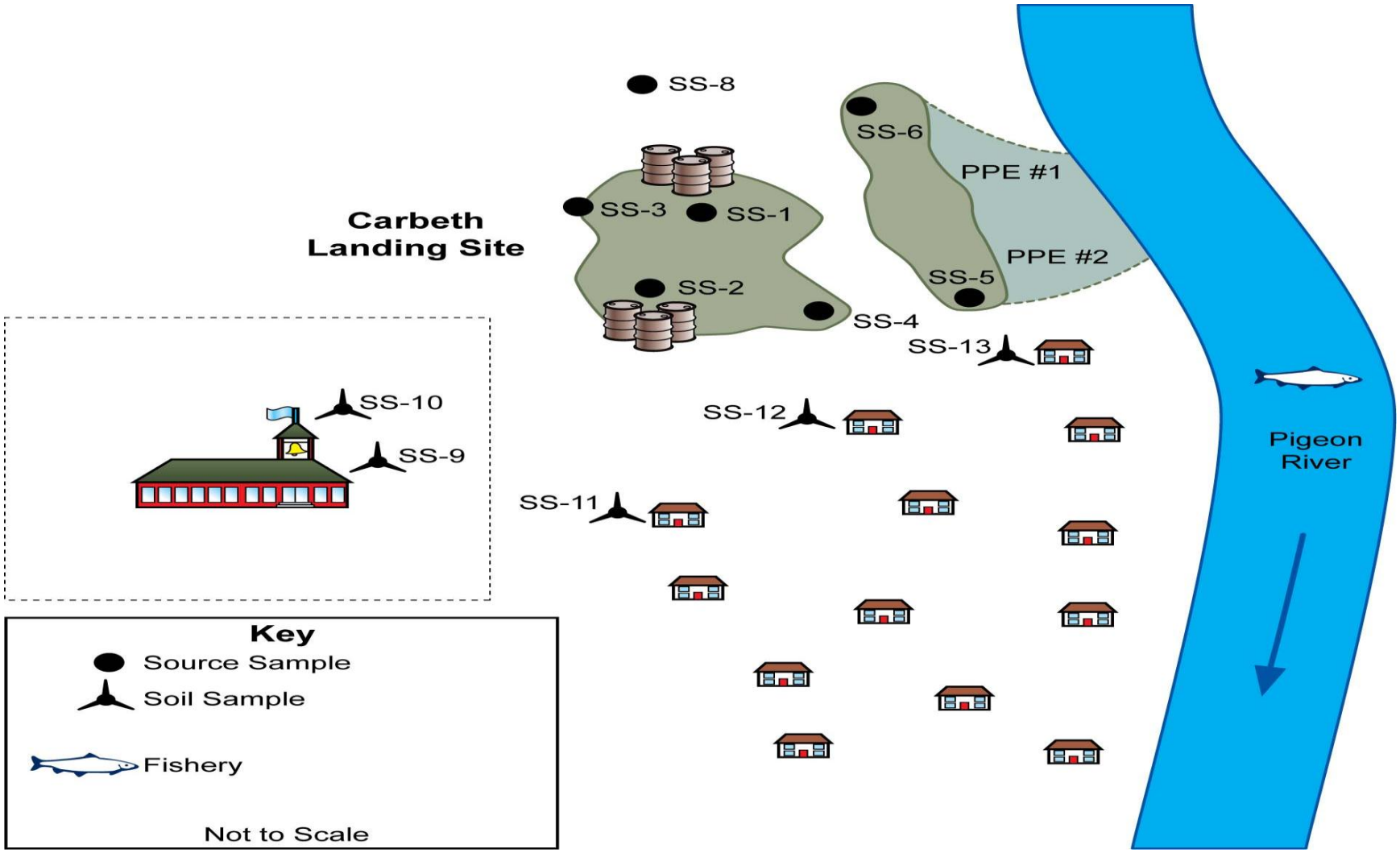
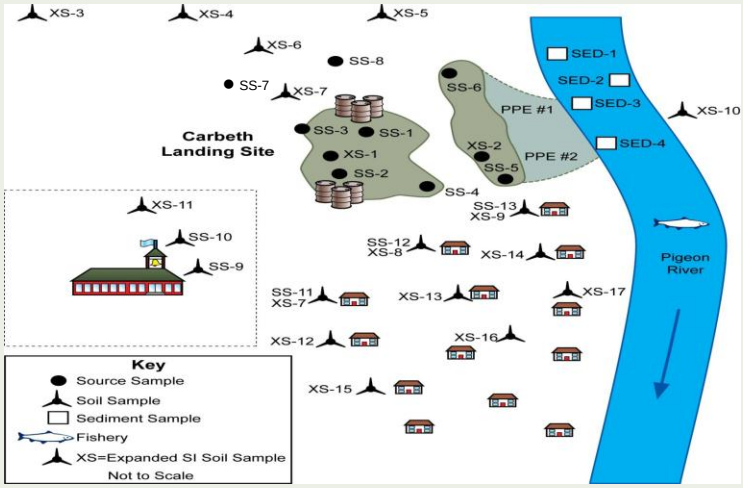

SS-8
SS-6
PPE #1
PPE #2
SS-5
SS-3
SS-1
SS-2
SS-4
Carbeth
Landing Site
SS-13
SS-10
SS-9
SS-12
SS-11
Pigeon
River
Key
Source Sample
Soil Sample
Fishery
Not to Scale

Carbeth Landing Site
Expanded SI Sampling Locations



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SI Strategies – Photographs of Soil Sampling

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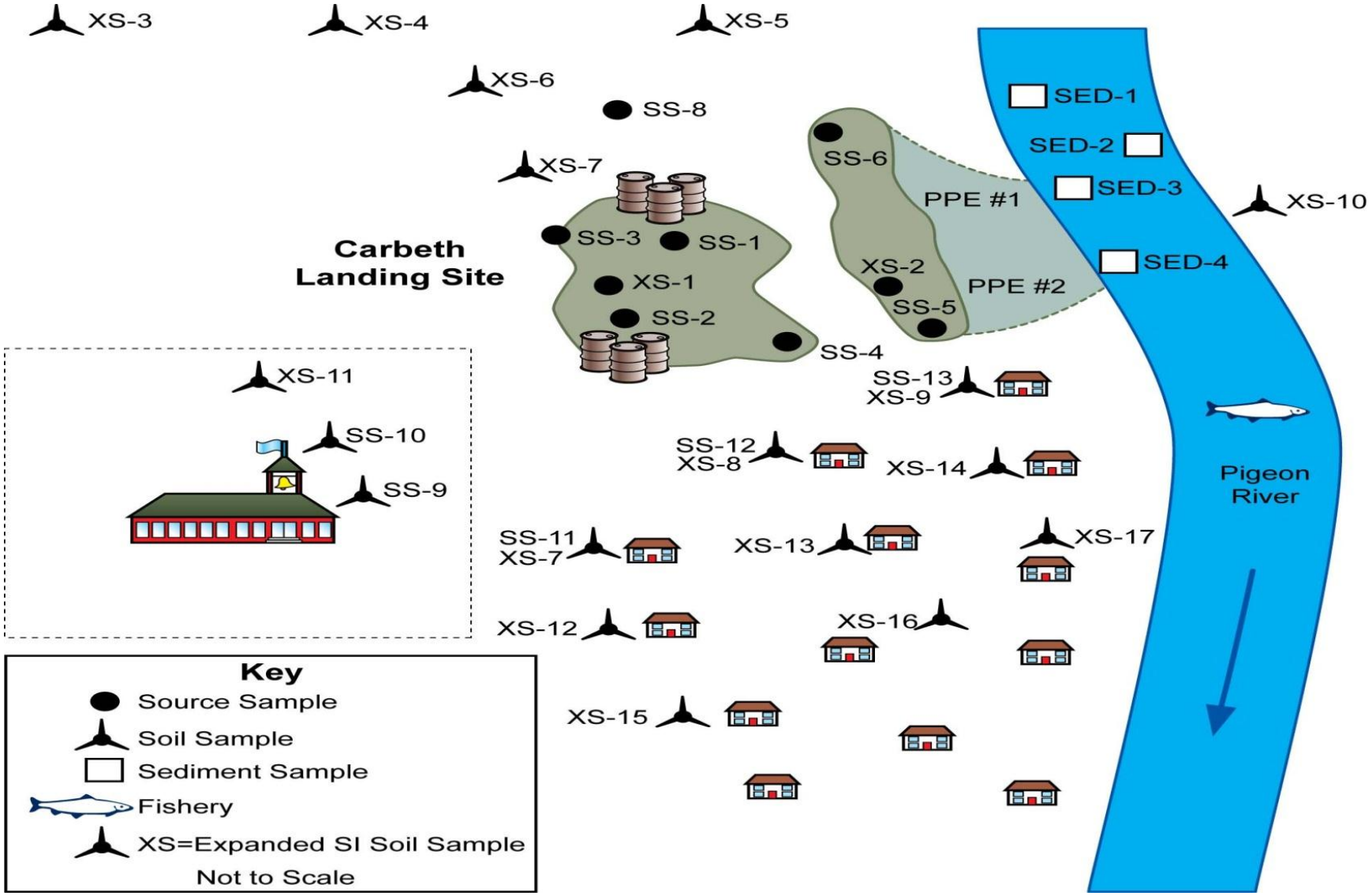
XS-3
XS-4
XS-5
XS-6
SS-8
XS-7
SS-6
SED-1
SED-2
SED-3
PPE #1
XS-10
Carbeth
Landing Site
SS-3
SS-1
XS-1
XS-2
PPE #2
SED-4
SS-5
SS-2
SS-4
XS-11
SS-13
XS-9
SS-10
SS-12
XS-8
XS-14
SS-9
Pigeon
River
SS-11
XS-7
XS-13
XS-17
XS-12
XS-16
XS-15
Key
Source Sample
Soil Sample
Sediment Sample
Fishery
XS=Expanded SI Soil Sample
Not to Scale

SI Strategies – Photographs of Soil Sampling

EPA 9-21

Summary

- **Exposure pathway, not a migration pathway**
- **Identify whether residential, school, daycare or work place properties are contaminated**
- **Observed contamination requires analytical data**
- **Contamination can be inferred between sampling locations**
- **Demonstrate attribution and determine level of contamination**

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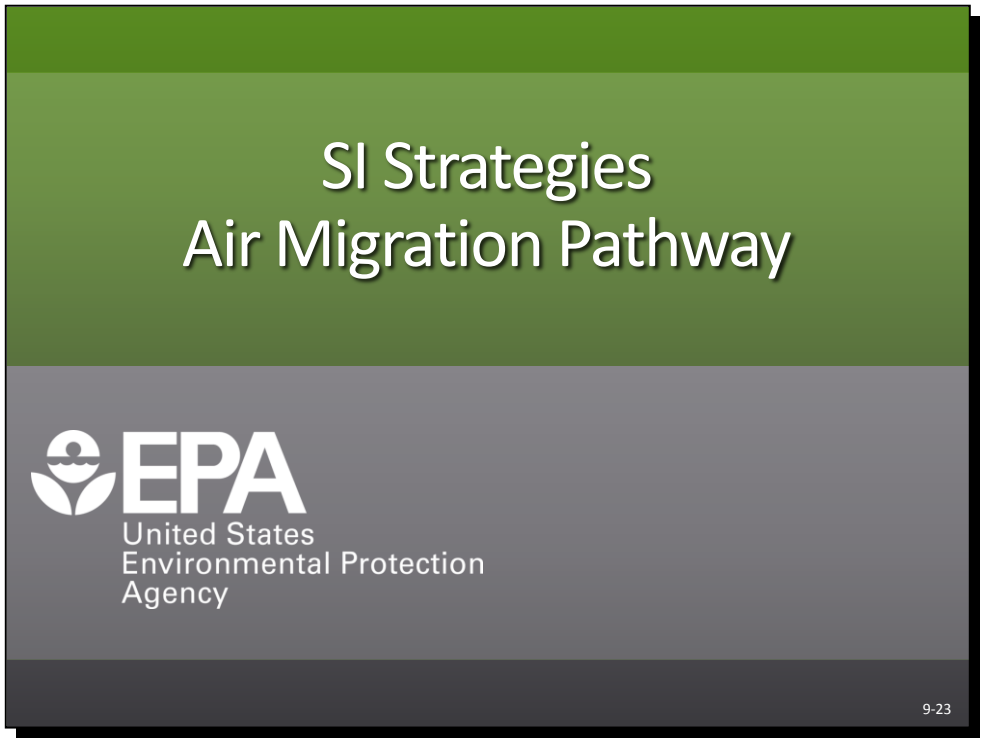
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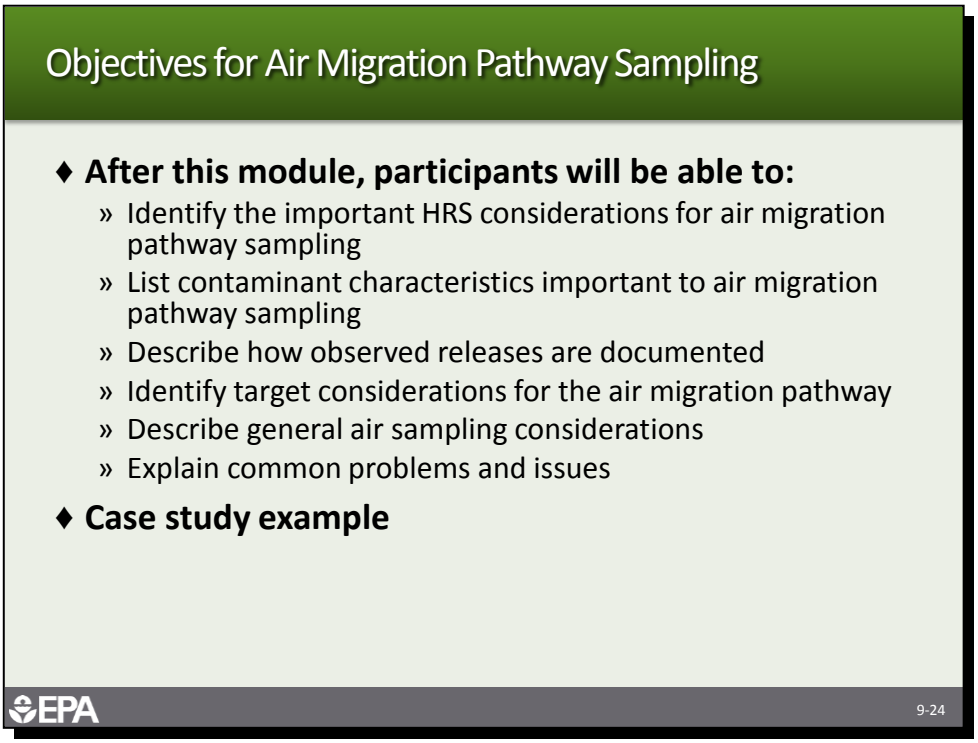


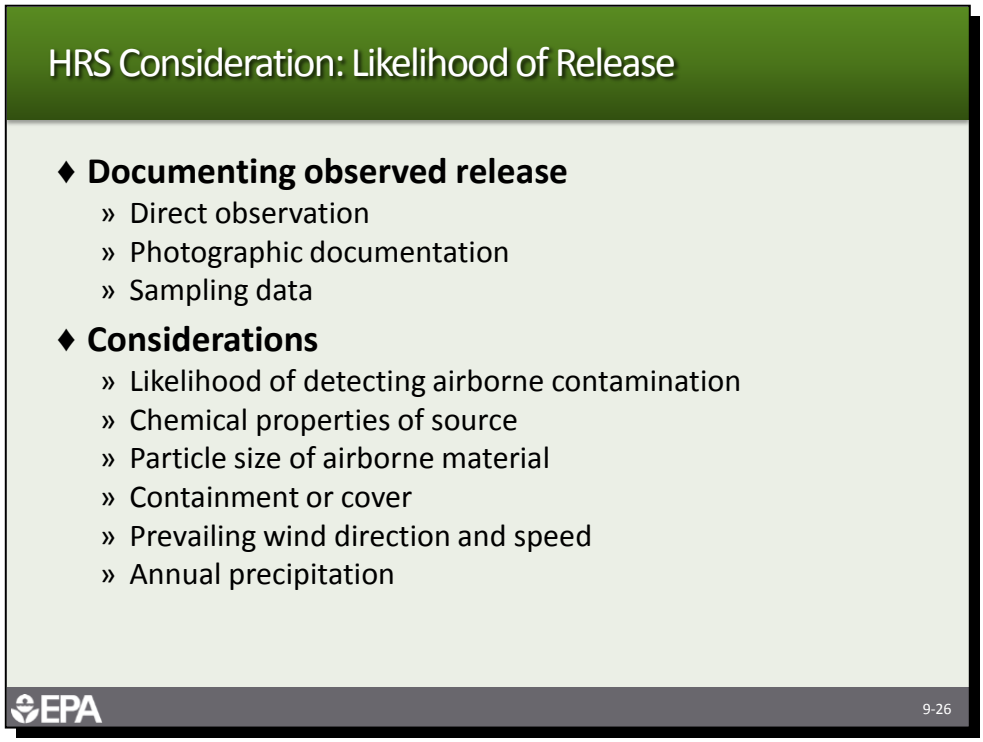
Notes

◆ This section presents information participants will need when deciding whether the air migration pathway can be scored and in designing a sampling strategy for the air migration pathway, if the air migration pathway is significant. Participants will learn (1) the important HRS considerations for the air pathway, (2) essential contaminant characteristics for the air migration pathway, (3) how to measure and document direct observations, (4) how to identify air migration pathway targets, (5) general considerations for air sampling, and (6) common problems and issues associated with air sampling.

◆ Participants will have the opportunity to see how air sampling strategies are applied by reviewing a case study example that examines site conditions and presents an air sampling strategy.

Notes

- The HRS considerations for air migration pathway scoring are the three factor categories of (1) likelihood of release, (2) waste characteristics, and (3) targets. Each of these factor categories has unique considerations for the air migration pathway.



Notes

- **Documenting observed release:** An observed release can be documented in two ways for the HRS: by direct observation and photographic documentation and by sampling data. Several considerations come into play in evaluating the likelihood of release to the air migration pathway.

- **Considerations:** The evaluator should use BPJ to evaluate the likelihood that airborne contamination from the site will be detected to evaluate whether air sampling should be conducted during the SI. The evaluator should consider the chemical properties for the contaminants associated with the sources at the site, including particle size and volatility. The condition of the sources, such as the presence or absence of cover, should also be evaluated. Finally, meteorological conditions, such as prevailing wind direction and speed and annual precipitation, should be evaluated.

Notes

- **Inhalation toxicity of contaminants:** The waste characteristics considerations include inhalation toxicity of the contaminants at the site. The SCMD lists inhalation toxicity for some contaminants. If the inhalation toxicities of site contaminants are high, the air migration pathway may play a more prominent role in the site assessment. If inhalation toxicities for site contaminants are low or unavailable, then air sampling may not be practical.

- **Mobility of gaseous and particulate contaminants:** The mobility of gaseous and particulate contaminants will alter the waste characteristic evaluation. The more mobile a contaminant, the higher the waste characteristic score will be.

- **Likelihood of detecting contaminants through sampling:** In planning the SI, the evaluator should assess the likelihood that contaminants will be detected through sampling. If air releases are sporadic or depend on other conditions, such as wind speed or barometric pressure, then it will be more difficult to design a sampling program that detects these sporadic releases. Likewise, if contaminants are highly volatile, it may not be possible to detect them with air sampling before they are diluted in the atmosphere.

HRS Considerations: Targets

- **No direct sampling of specific air migration pathway targets is necessary**
- **If sampling, sample within TDLs**
- **Use air emission models**

EPA 9-28

Notes

- **No direct sampling necessary:** Unlike other pathways, direct sampling of air targets suspected to be exposed to contamination is not required. Instead, an air observed release allows any person regularly present or any sensitive environment within the distance category, or a closer one, to be evaluated as subject to actual contamination.
- **If sampling, sample within the TDL:** Air sampling should be conducted within the TDLs that may be affected but that are close enough to the source to detect releases to air.
- **Use air emission models:** Air emission models can be used to support scoring the air migration pathway. Air emission models can estimate the area affected by the release of contaminants. A wind rose can be used or air modeling software.

Determining Likelihood of Release: Observed Release by Direct Observation

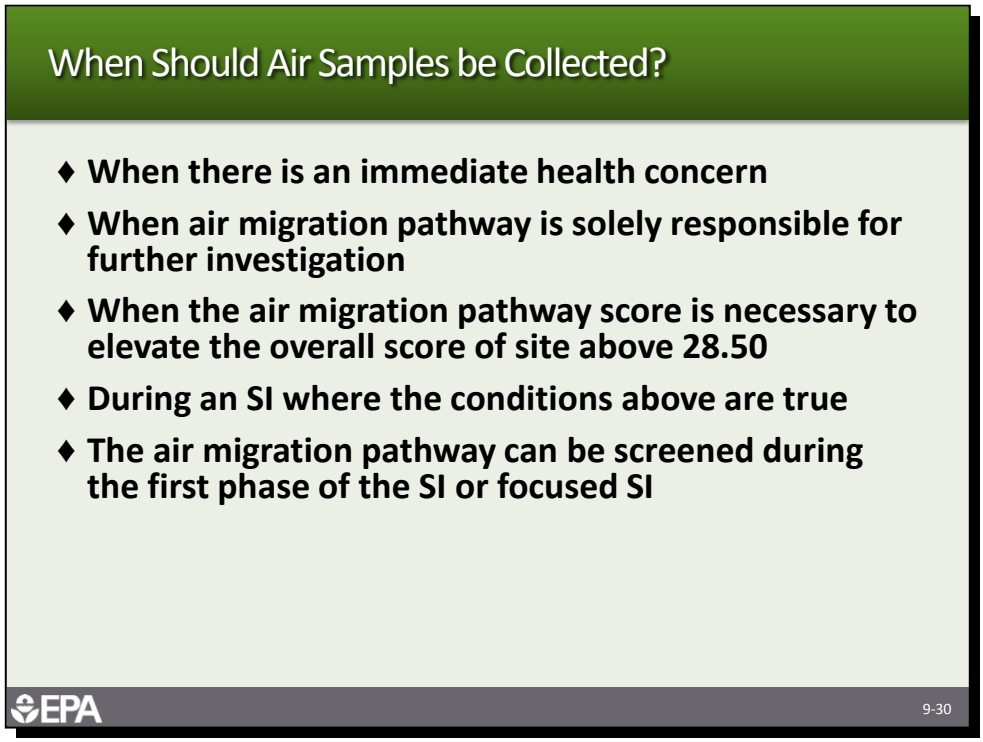
- **Direct observation can be visual**
- **Photographic evidence is required**
- **Analytical results to confirm presence of hazardous substance**
  - » Existing data
  - » Soil or source samples
  - » Waste manifests

EPA 9-29

Notes

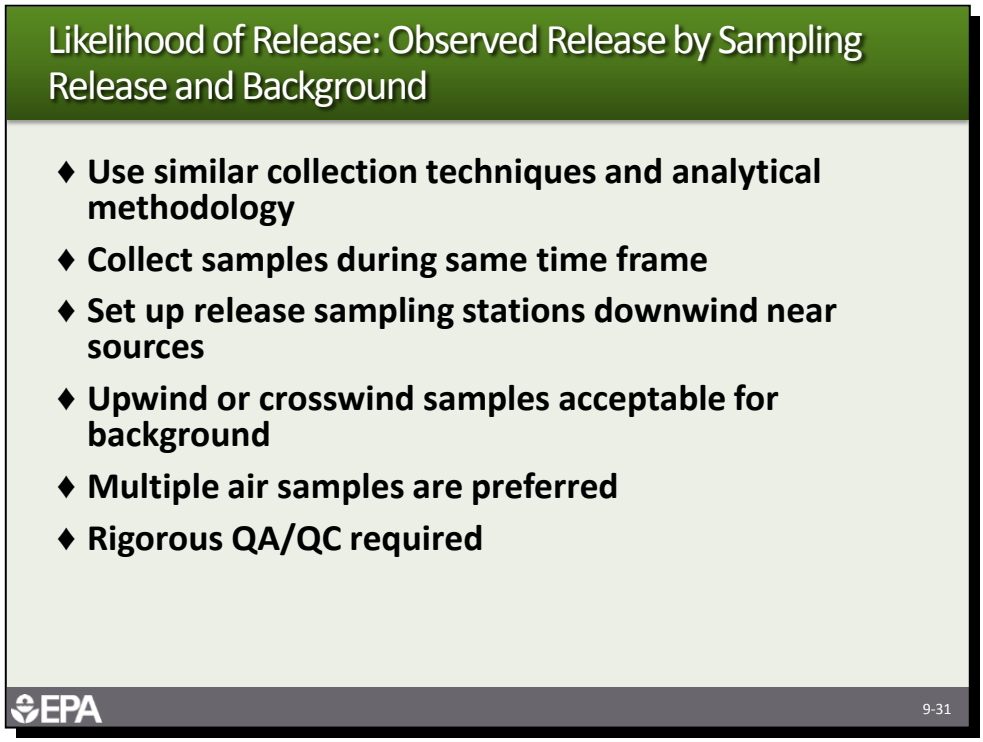
- **Direct observation can be visual:** In some instances, direct observation can be visual by witnessing the release of vapors, smoke or particulates from source areas. The photograph above shows a cloud of smoke from the site. A common occurrence of direct observation from a source is visible tailings blowing from a tailings pile.
- **Photographic evidence is required:** These releases must be documented by photographs or videos. Logbook documentation can also support observed release by observation.
- **Analytical results to confirm presence of hazardous substances:** The direct observation of a release must also include analytical results to show that the source contains a hazardous substance. Several sources of data may be used, including existing data, soil or source samples, or waste manifests, as long as the quality of the data can be documented.

  If observed release by direct observation is observed during field work, take photographs of the release, document in the field logbook notes and collect a sample of the source from where the release was observed,



Notes

- **When there is an immediate health concern:** If the PA concludes that the air migration pathway may present an immediate health concern, then air sampling should be conducted to assess whether an immediate health concern exists.
- **When air migration pathway is solely responsible for further investigation:** Air sampling should be conducted if the air migration pathway is the sole reason that the site was recommended for further investigation. If, however, the site will clearly score above 28.50 with other pathways, then air sampling should not be conducted.
- **When air migration pathway score is necessary to elevate the overall site score above 28.50:** Air sampling may be needed if the air migration pathway score is necessary to elevate the overall site score above 28.50 and there are clear indications that the air pathway will score.
- **During SI where the conditions above are true:** Air samples are usually collected as part of the second phase of the SI, after other data has been collected that allows judgments about the necessity of scoring the air migration pathway can be made.
- **The air migration pathway can be screened during the first phase of the SI:** Air sampling is usually not conducted as part of the first phase of the SI, but air screening, such as sampling near sources with air monitoring instruments like a photoionization detector (PID) or flame ionization detector (FID), is usually conducted. The results of screening can be used to devise air sampling strategies during the second phase of the SI.



Notes

- **Use similar collection techniques and analytical methodology:** It is important to use similar collection techniques and analytical methodologies for both types when collecting air samples to demonstrate a release and to establish background. Samples should be collected at the same height above the ground and in the breathing zone. Samples should not be collected from rooftops or from near the ground. Rooftop samples are too high up, and samples from near the ground may have artificial contamination from ground disturbance. Dust and wipe samples from surfaces cannot be used to establish an air release for the HRS.

- **Collect samples during same time frame:** Release and background samples must also be collected at the same time and for the same amount of time. The release mechanism, such as volatilization or fugitive dust emissions, will dictate the best time of year to sample and the length of time to collect the samples.

- **Set up release sampling stations downwind near sources:** The SI guidance recommends setting up release sampling stations downwind of and near sources. The air sampling strategy should account for any potential changes in wind direction.

- **Upwind or crosswind samples acceptable for background:** Background sampling stations can be either upwind or crosswind from the sources. Background samples should not be affected by the site.

- **Multiple air samples are preferred:** The SI guidance recommends multiple air sampling stations for both release samples and background samples.

- **Rigorous QA/QC required:** Rigorous QA/QC of the air sampling effort is necessary to meet the strict requirements of the HRS model. The QA/QC program for the air sampling effort must be fully documented.

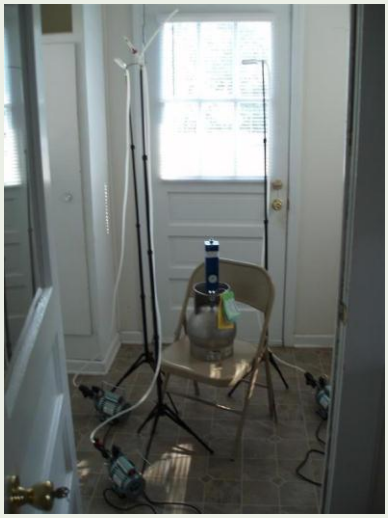
Example of an Air Sampling Station

- Photo shows high and low volume sampling station, sampling cassette is on a tripod about 4 feet off the ground
- Aircon 2 air sampling pumps used

EPA 9-32

Air Samples Collected Indoors

- Air samples collected indoors are not acceptable to document observed release for the air migration pathway
- Air samples should be collected outside from ambient air
- Sampling station in photograph is not acceptable for HRS scoring



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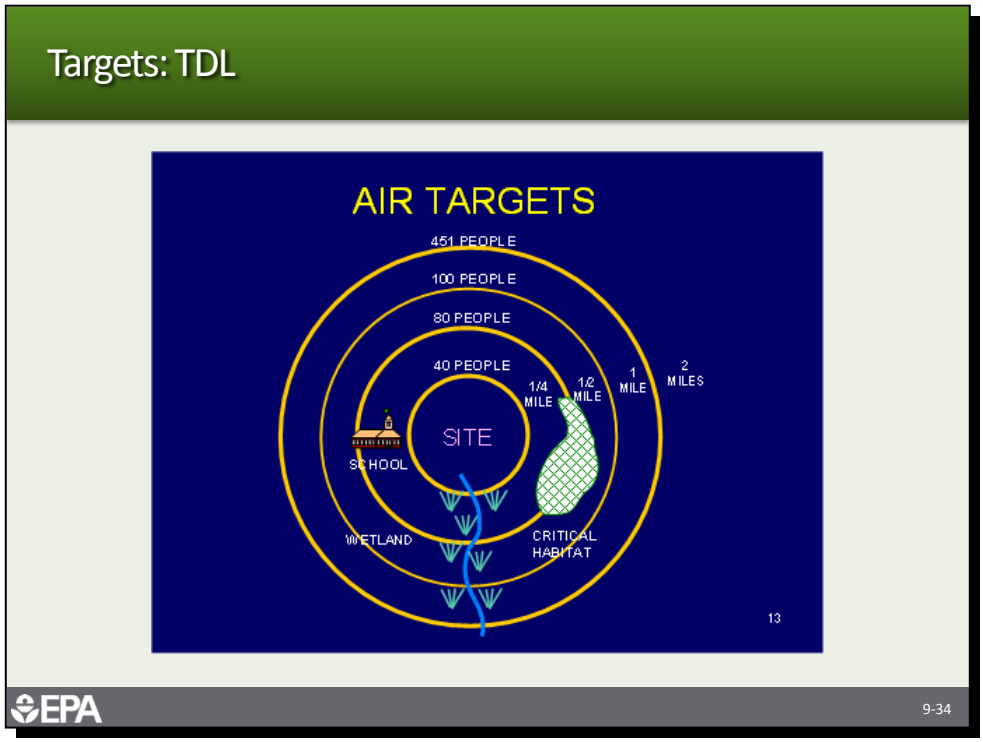

Notes

- The TDLs for air sampling are the ¼-mile, ½-mile, 1-mile and 2-mile radius from the site. The score for the ¼-mile TDL will be the highest and should usually be the focus of the sampling effort. Sensitive environments within the TDLs can also be scored.
- An observed release can demonstrate actual contamination of targets within the TDLs. The use of various emission models may be needed to support exposure determinations; however, these models may be difficult to use.
- Target sampling is conducted if public health is threatened; the ¼-mile TDL is usually sampled because it produces the highest score.

General Air Sampling Considerations

- **Collect air samples before or after other media sampling**
- **Use the same air sampling volume for all sampling stations**
- **Collect meteorological data while samples are collected**
- **Photo shows meteorological data collection and sampling in the breathing zone**

(continued)

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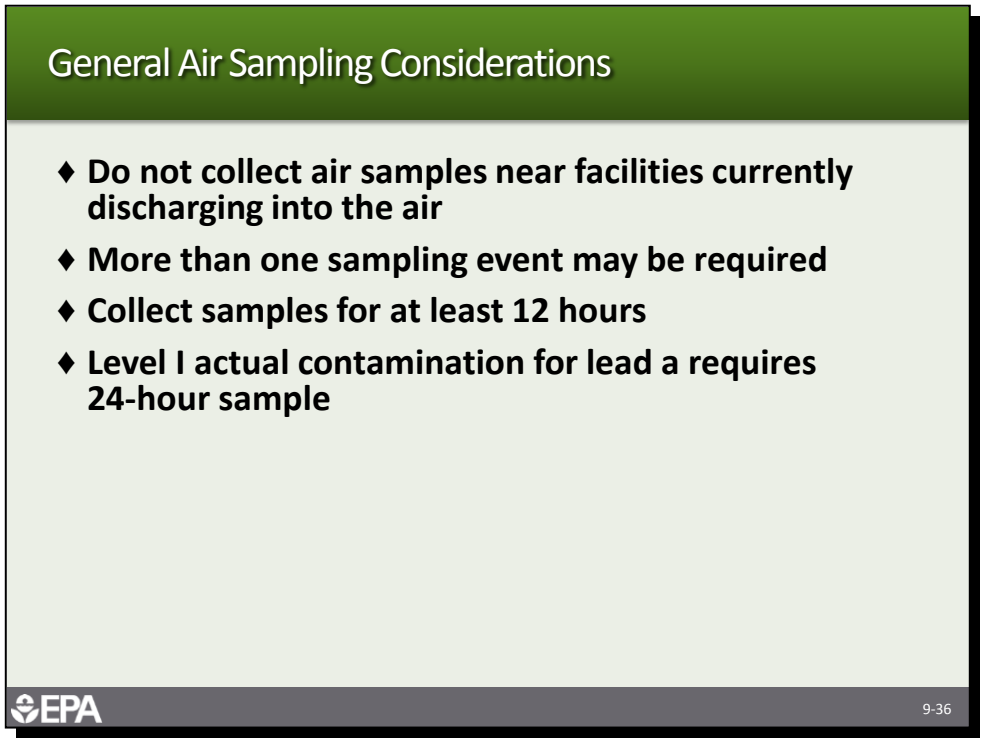
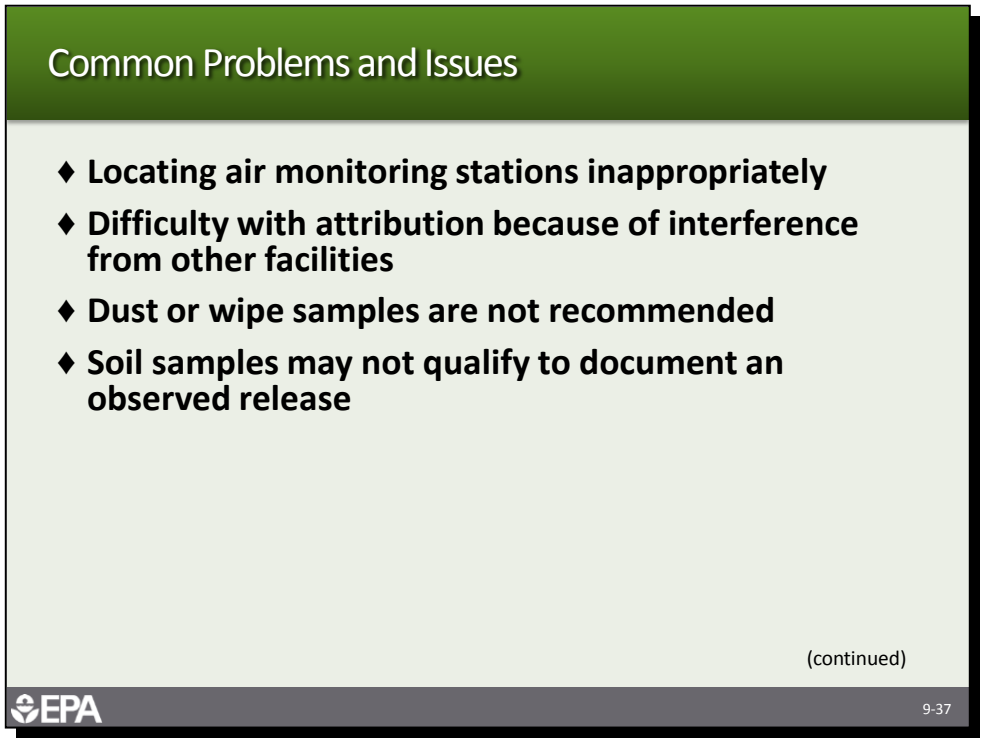
Notes

- **Collect air samples before or after other media sampling:** No other samples should be collected while air sampling is occurring. This approach ensures that detections of contamination cannot be attributed to disturbance of the site or source from other SI activities.
- **Use the same air sampling volume for all sampling stations:** All release and background samples should sample the same volume of air. Continuous air samples should use pumps that are calibrated to collect air at the same rate.
- **Collect meteorological data while samples are being collected:** Each air sampling station should include a meteorological station that collects continuous meteorological data throughout the air sampling event. This is important so that the wind direct can be monitored and documented in the event that the background air sampling station need to be relocated.



Notes

- **Do not collect air samples near facilities currently discharging into the air:** Release and background samples should not be collected near facilities that may currently be discharging into the air to help avoid attribution issues that could be raised if contaminants are detected.
- **More than one sampling event may be required:** More than one sampling event may be required to satisfy the requirements of the HRS model to detect a release and to overcome changes in weather.
- **Collect samples for at least 12 hours:** The SI guidance recommends collecting samples for at least 12 hours to account for changes in weather that may occur over time. The actual sample collection time should be selected based on potential weather conditions, contaminant characteristics and likely release mechanisms.
- **Level I contamination for lead requires 24-hour sample:** Level I actual contamination for lead under the HRS requires a 24-hour sample.



Notes

- **Locating air sampling stations inappropriately:** The location of air sampling stations is critical. The location of the release stations must be close enough to the source to be able to detect a release and to attribute detection of contamination to the source. Background samples cannot be located in areas that may be affected by the source.
- **Difficulty with attribution because of interference from other facilities:** It may be difficult to attribute the contamination to the site if there is potential interference from other facilities that may be contributing to air contamination. Background samples should be collected in areas that are not affected by other facilities.
- **Dust or wipe samples are not recommended:** Dust or wipe samples collected from surfaces cannot be used in an HRS package. However, they can be used to assess the urgency of potential health threats and may help guide an air sampling strategy.
- **Soil samples may not qualify to document an observed release:** Soil samples that show contamination from the site may not qualify to document an observed release because the contamination may not be the result of the air transport mechanism.

Common Problems and Issues

- **Soil gas surveys do not provide quality of data needed**
- **Sample results from PID or FID do not provide quality of data needed**
- **Precipitation and high or low barometric pressure during sampling may affect results**
- **Air releases in closed structures are not considered observed releases**

EPA 9-38

Notes

- **Soil gas surveys do not provide quality of data needed:** Soil gas surveys may be useful in devising an air sampling strategy but do not provide data of sufficient quality to be used for HRS scoring.
- **Sample results from PID or FID do not provide quality of data needed:** Sample results from a PID or FID also may be used to devise an air sampling strategy but do not provide the quality of data needed for HRS scoring.
- **Precipitation and high or low barometric pressure during sampling may affect results:** Changes in weather during the air sampling event may affect the results of the sampling and may be a reason to conduct more than one sampling event. Changes in weather that may affect results include precipitation, high barometric pressure, low barometric pressure and changes in wind direction.
- **Air releases in closed structures are not considered observed releases:** Releases to air in closed structures are not considered observed releases and cannot be used to evaluate the air pathway.

Case Study Example

Vega Ore Site
SI Sampling Strategy

9-39

Vega Ore Site
PA Findings

- **Remote site near Smalltown**
- **Ore processed for extraction of lead, zinc and silver since 1930s**
- **Current site activities are limited**
- **Waste sources**
  - » Three tailings piles
  - » Drum storage area for acids
  - » Aboveground tank

(continued)

EPA

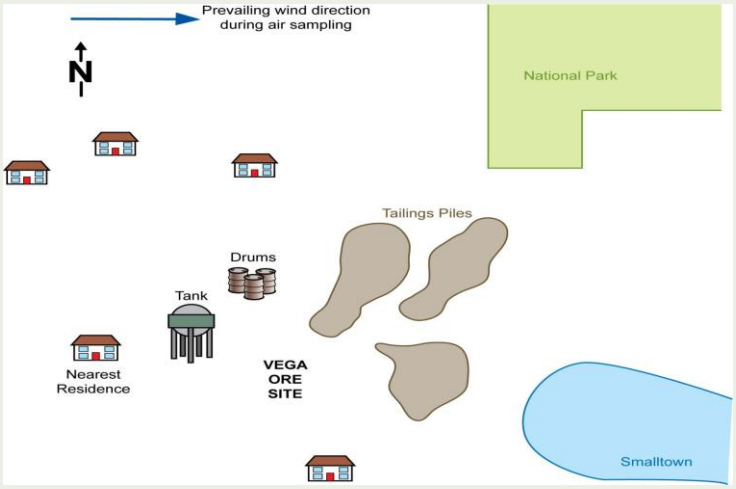
9-40

Vega Ore Site
PA Findings

- **Nearest residence is 1,000 feet from tailings pile**
- **Smalltown relies on drinking water from an intake 3 miles away**
- **A national park is located 900 feet from the site**
- **Six ranches within 0.25 miles of the site rely on bottled water and cisterns for drinking water**
- **No groundwater targets**
- **Nearest surface water body is more than 2 miles away**

EPA 9-41

Vega Ore Site
Site Map



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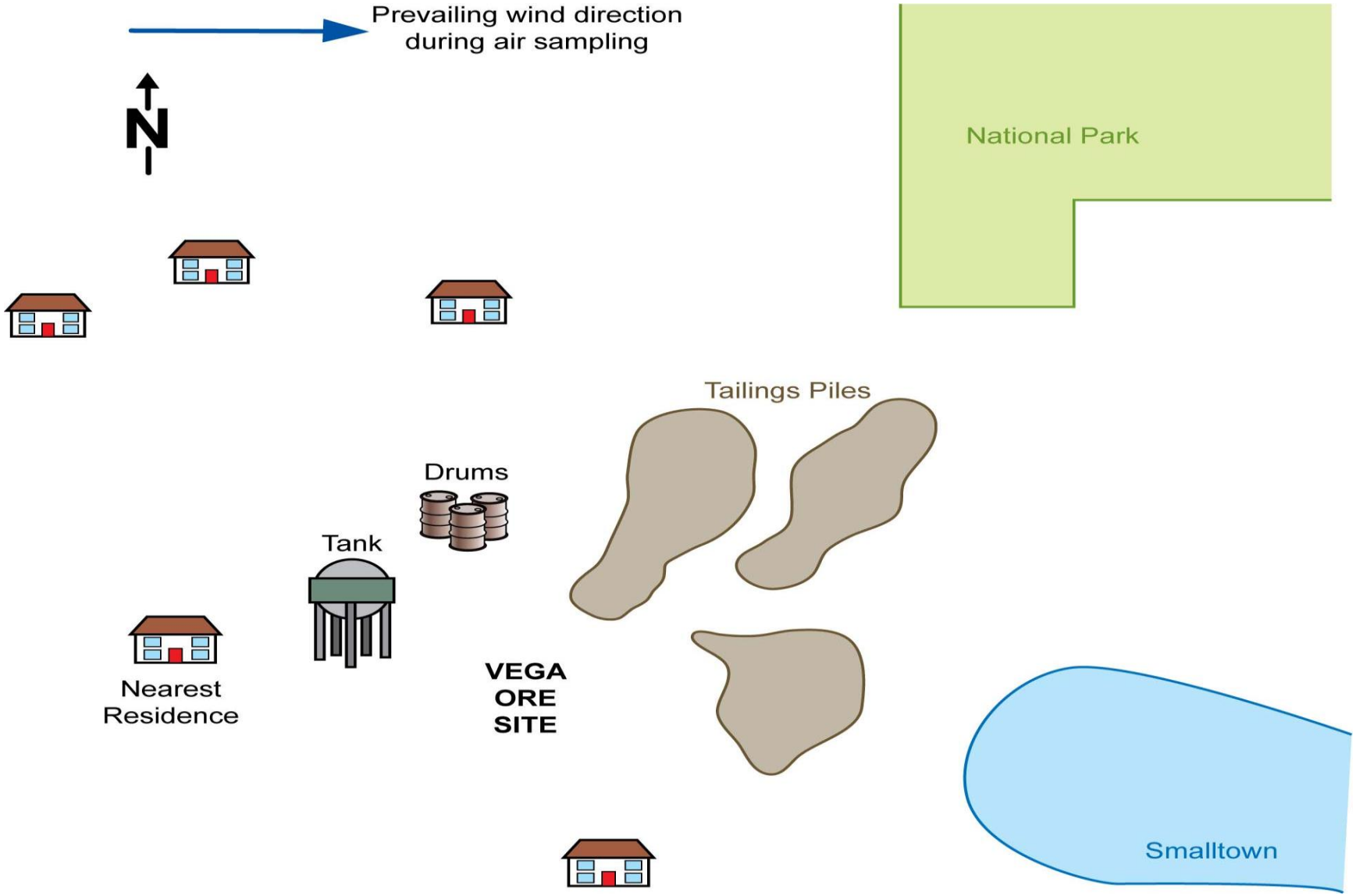

Prevailing wind direction
during air sampling
N
National Park
Tailings Piles
Drums
Tank
Nearest
Residence
VEGA
ORE
SITE
Smalltown

Vega Ore Site
SI Sampling Considerations

- **Air is the only pathway that may be affecting people and sensitive environments targets**
- **An SI is planned**
- **Air sampling for particulates within 0.25 mile TDL and background**
- **Collect source samples for attribution**

(continued)

EPA 9-43

Vega Ore Site
SI Sampling Considerations

- **Air sample collection should last for 12 hours**
- **Lead sampling requires 24-hour sample collection**
- **Consider wind direction, speed, air temperature and other meteorological conditions when establishing air sampling locations**
- **Continuously monitor meteorological conditions during sampling**

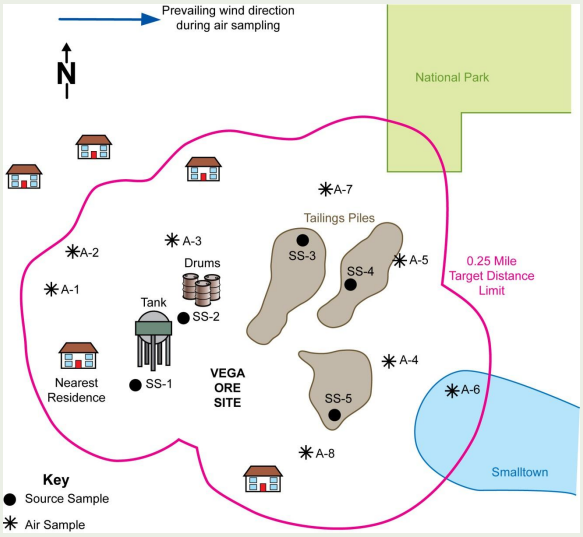
EPA 9-44

Vega Ore Site
SI Sampling Strategy

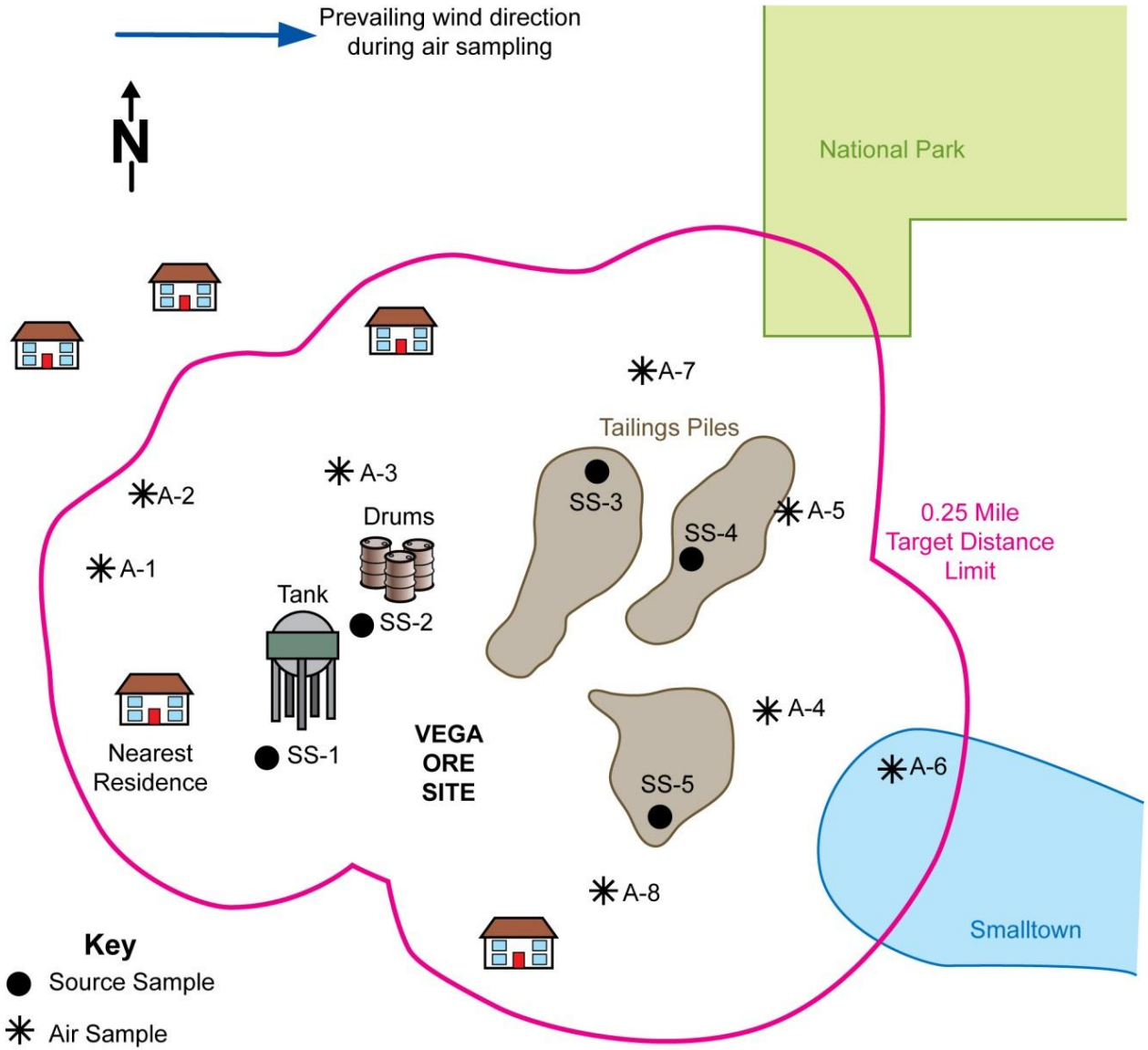
Samples	Approach	Rationale	Non-sampling Data
Release and Air Targets (A-4 through A-6)	Determine presence and levels of contaminants Monitor meteorological conditions	Determine whether 0.25-mile TDL is exposed to actual contamination	Population of Smalltown in 0.25-mile TDL Number of workers at site Boundaries of national park
Support for Release and Air Targets (A-7 and A-8)	Determine if other sources exist Changes in wind direction Establish cross-wind stations	Support determining whether 0.25-mile TDL is exposed to actual contamination	
Background (A-1 through A-3)	Determine background levels of ambient air Determine background soil levels	Relative levels of particulate hazardous substances in ambient conditions Ensure sufficient background samples	Identify other sources Collect descriptive information for all background samples
Sources (SS-1 through SS-5)	Identify hazardous substances present in soil/ tailings piles	Not to increase HWQ – amounts are not close to break points	Obtain physical dimensions Confirm number of drums
Quality control (Q-1 through Q-4)	Monitor collection and decon techniques 2 trip blanks and 2 duplicates	Ensure sufficient QA/QC	

EPA 9-45

Vega Ore Site
SI Sampling Locations



EPA 9-46


Prevailing wind direction during air sampling
N
National Park
A-7
Tailings Piles
A-3
A-2
Drums
SS-3
SS-4
A-5
0.25 Mile Target Distance Limit
A-1
Tank
SS-2
Nearest Residence
SS-1
VEGA ORE SITE
A-4
SS-5
A-6
A-8
Smalltown
Key
Source Sample
Air Sample

Summary

- **SI sampling should be designed to maximize the overall site score in a cost-effective manner**
- **Confirm PA hypotheses that are driving the HRS score**
- **The SI should identify all site conditions that may need to be addressed immediately**

(continued)

EPA 9-47

Summary

- **SI sampling strategies must consider the unique HRS requirements that apply to:**
  - » Sources
  - » Targets
  - » Groundwater, surface water, soil exposure and air pathways
- **Address special pathway considerations for:**
  - » Likelihood of release
  - » Waste characteristics
  - » Targets

EPA 9-48

Course Review

- **The course was designed to instruct participants on:**
  - The scope and activities for a PA and SI
  - The legal and regulatory framework and EPA guidance and policies that apply to CERCLA site assessments

  AND
  - Provide opportunities to evaluate and score a site using PA-level information as well as evaluate SI sampling strategies

EPA 9-49

Course Objectives Review

- **Participants should be able to:**
  - Explain when, where, why and how site assessments are performed under CERCLA authority
  - Prepare for, conduct and report the results of a PA
  - Assess the need for, conduct and report the results of an SI
  - Identify and use guidance, software and other tools to successfully meet the requirements for a CERCLA PA and SI

EPA 9-50

Conclusion

- **THANKS for your participation and interest!!!**
- **Please complete and return the participant's course evaluation form (we really do review and use them to improve the course)**
- **GOOD LUCK and SUCCESS in the future!!!**

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