

# Module 1

## Introduction

# Introduction

- Clarify the purpose of this course
- Tell you about your instructors
- Learn who our students are
- Understand your expectations and needs
- Lay out the broad objectives of the course

# Introduction



*Who are you? Who are we?*

# Purpose

The course, “Planning and Use of Data for Site Assessment” was developed to help you ensure that data are adequate for making site assessment decisions and to discuss what makes them adequate.

# Objectives

- **Data needs for HRS and NPL eligibility.**
- **Learn how to:**
  - **Develop and use a conceptual site model (CSM);**
  - **Apply systematic planning to your project;**
  - **Identify your data needs;**
  - **Sample smart – get the right samples so that you get the right data; and**
  - **Assess data adequacy**

# Module 2

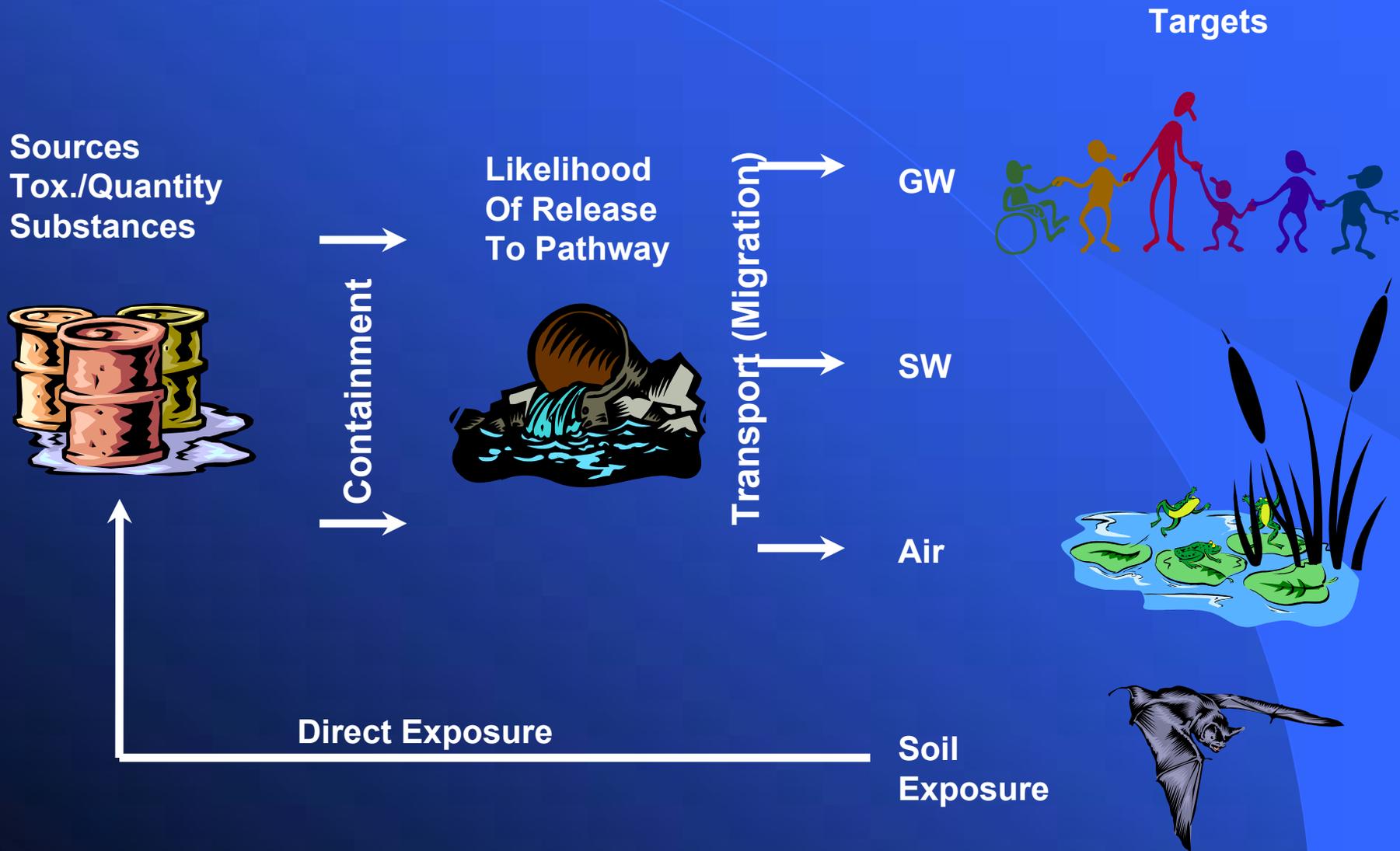
## “Sizing Up Your Site’s Data Needs”

# Know Your Site

*Start Developing your  
“Conceptual Site Model” (CSM)*

- **Historical ownership and operations give clues about data needs.**
- **Current conditions – How have things changed?**
- **What’s the problem at my site?**

# HRS Conceptual Site Model



# Example HRS Scoresheet

## SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

<u>Factor Categories and Factors</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
DRINKING WATER THREAT		
<u>Likelihood of Release</u>		
1. Observed Release	550	<u>550</u>
2. Potential to Release by Overland Flow		
2a. Containment	10	<u>NS</u>
2b. Runoff	25	<u>NS</u>
2c. Distance to Surface Water	25	<u>NS</u>
2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	<u>NS</u>
3. Potential to Release by Flood		
3a. Containment (Flood)	10	<u>NS</u>
3b. Flood Frequency	50	<u>NS</u>
3c. Potential to Release by Flood (lines 3a x 3b)	500	<u>NS</u>
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	<u>NS</u>
5. Likelihood of Release (higher of lines 1 and 4)	550	<u>550</u>

# Pathways and Targets

- **Functional aspects of the HRS determine the type and quality of data needed to complete the CSM for my site?**
- **What HRS pathways/routes of exposure are affected?**
- **HRS factor values table ranges define the data you need to collect.**

# HRS Pathway Factors

## ■ Likelihood of Release

- Can an observed release be supported with existing data or do I need to collect samples?

## ■ Waste Characteristics

- How much waste is present? Do I need to measure sources to confirm existing data?
- What hazardous substances are present in sources?

## ■ Targets

- Who or what is (or might be) exposed to contamination? Do I need to collect samples to prove targets are exposed?

# How Much Data Already Exist?

- Consider previous sampling events and conclusions drawn from those data.
- What non-analytical data are available and what do they tell me about site problems?
- Can you complete your CSM with existing data, or do you need to collect additional data?

# Might NPL Listing be Challenged?

- Who might challenge or support listing on the NPL?
  - Potentially responsible parties
  - Community groups
  - State, tribal, and local governments
  - Other stakeholders
- NPL listing is the hurdle – How high is it?

# Past Data Challenges

- Kent County, DE v. EPA – Jan. 1992
- Anne Arundel Co., MD v. EPA – Feb. 1992

# More Past Data Challenges

- **Board of Regents of the University of Washington v. EPA – April 1996**

# Analyte Concentration: Yes Or No?

- Do I need to compare the result or analyte concentration to a numerical value (e.g., SQL, background level, benchmark, etc.)?
  - If yes, then quantitative data are needed.
  - If no, then qualitative data may suffice.

# Data Type Considerations

- Understanding the intended use, the type and the quality of data needed is fundamental to selecting appropriate measurement methods.
- Other factors such as detection limit, sensitivity, regulatory criteria, level of contamination, and site-specific conditions also factor into this selection.

# Recommended Data Types for HRS Factors

## HRS Factor

## Type of Data

Observed Release

Quantitative/Qualitative

Release Attribution

Quantitative/Qualitative

Substance ID

Qualitative

Source Boundaries

Qualitative

Source Containment

Qualitative

Actual Contamination

Quantitative

Haz. Constituent Quantity

Quantitative

# Take A Scientific Approach

- Hypothesis
- Plan to test hypothesis
- Develop methodologies
- Collect data
- Review results
- Draw conclusions

# Exercise 1

## LPQ Conceptual Site Model

# Module 3

## Systematic Planning

# What Is Systematic Planning?

- A framework for planning data collection activities that ensures, through a step-by-step and iterative process, that project goals will be met.

# Why do Systematic Planning?

- To ensure the most effective data collection design that meets project goals.
- To establish measurable performance criteria.
- It is required by EPA Order 5360.1 CHG2 (May 5, 2000) *Policy and Program Requirements for the Mandatory Agency-Wide Quality System.*

# What Does EPA Require For Systematic Planning?

- 1. Identify all parties who will contribute to the quality of the environmental program or use the results.**
- 2. Identify goal and issues to be addressed.**
- 3. Identify project schedule and any applicable requirements.**
- 4. Identify the type of data needed how the data will be used to support the objective of the project.**

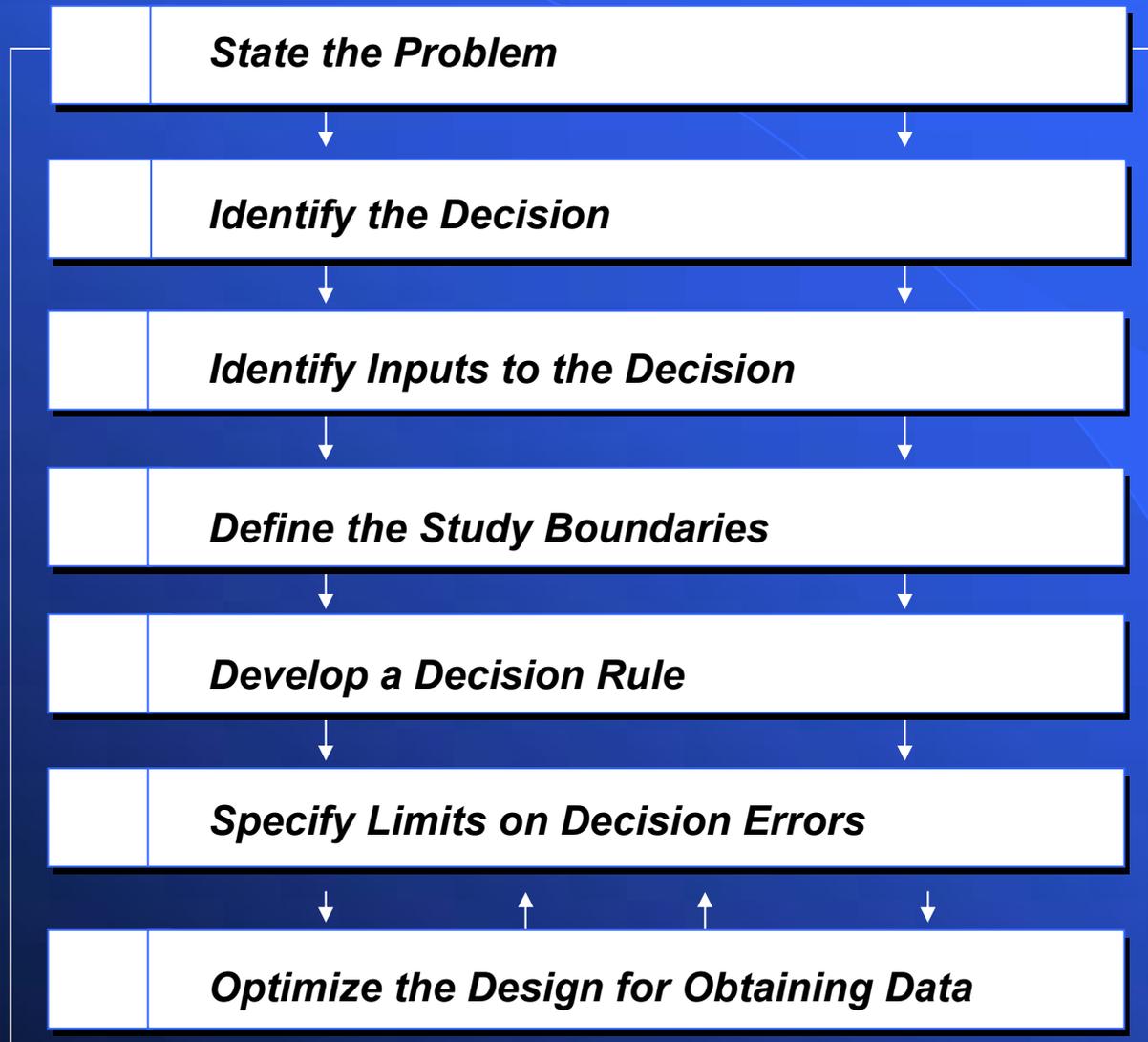
# What is Systematic Planning (Cont)?

5. Specify QA and QC activities needed to assess the data quality.
6. Describe how the data will be analyzed, evaluated, and assessed.

# Data Quality Objective (DQO) Process for Systematic Planning for Site Assessment

- The DQO Process is a series of planning steps based on the “Scientific Method.”
- It is well-suited to planning for Site Assessment activities and decision-making
- It can ensure multiple uses of data, if appropriate

# DQO Planning Process Steps



# *SA Activities*

## **Step 1 – State the Problem**

- Organize and review the PA information and appropriate guidance documents.
- Develop a clear description of the problem to be solved based on existing information.
  - This becomes the initial Conceptual Site Model (CSM) and identifies data gaps.
- Specify resources/time limits required.
- Consider statutory exclusions.
- Identify regional, state, and tribal personnel for planning team.

## *SA Activities*

# Step 2 – ID the Decision

- Determine whether the contaminants at the site appear to pose risks to human health and the environment sufficient to support listing on the NPL.
- If analytical and other data yield a HRS score greater than 28.5, the site is eligible for the NPL.

# *SA Activities*

## **Step 3 – ID Inputs**

- **Identify environmental pathways to be measured.**
- **Determine pathways that may provide sufficient information for a decision (confirm the PA hypothesis).**
- **Identify additional non-sampling information that may be required.**
- **Critical samples are those that are critical to the defensibility of the site score and those that drive the site score.**

## *SA Activities*

# **Step 4 – Define Study Boundaries**

- **Identify the smallest population that can be used for the decision.**
- **Identify pathways to be sampled and most advantageous season for sampling.**
- **Specify populations and sensitive environments affected through each pathway.**

# *SA Activities*

## **Step 5 – Develop A Decision Rule**

- Specify how the data will be used in the HRS to make a decision.
- Confirm that all analytical data to be collected are needed.
- Determine data category (type and quality of data) needed.
- Determine sampling and analysis methods.
- Develop a logical “If... then....statement that defines the conditions that would cause the decision maker to choose among alternative actions.

## *SA Activities*

# Step 6 – Specify Limits on Decision Errors

- State constraints as acceptable qualitative or quantitative probabilities of incorrect decisions (i.e., false positive and false negative errors).
- Define sampling errors that would produce false positives and false negatives.
- Establish the acceptable uncertainty.
  - The HRS does this for you when evaluating an observed release by chemical analysis.

## *SA Activities*

# Step 7 – Optimize Design for Obtaining Data

- Develop and evaluate sampling design strategies so that HRS scoring decisions can be made on collected data.
- For each identified design, estimate score and anticipated error rates.

*The result of this process is the QAPP/SAP, which specifies data quality documentation needed for SA decisions.*

# Summary

- **A Systematic Planning Process is an Agency Requirement.**
- **The DQO process works well for SA activities.**
- **The result of the Systematic Planning Process is the Quality Assurance Project Plan which includes the Sampling and Analysis Plan (required for all EPA and EPA-sponsored data collection)**
- **Required by EPA Order 5360.1 CHG2 (May 5, 2000) *Policy and Program Requirements for the Mandatory Agency-Wide Quality System.***

# Exercise 2

## Systematic Planning

# Module 4

## Smart Sampling

# Overview

Four main parts of a sampling event:

1. Sample event planning (work planning)
2. Collecting samples
3. Field analysis
4. Evaluating the resulting data

# Sample Event Planning

- Assemble a team of technically qualified and experienced staff familiar with both established and innovative technologies.
- Build flexibility into your sampling and analysis plan – “Dynamic Work Plans.”
- Focus on gaps in data.

# Sample Event Planning (Cont.)

## Three Basic Sample Planning Questions

Use your CSM to answer three basic questions:

1. What is the purpose of each sample?
2. How will the analytical results of each sample be used?
3. What level of data quality do I need in order to use the sample results as I intended?

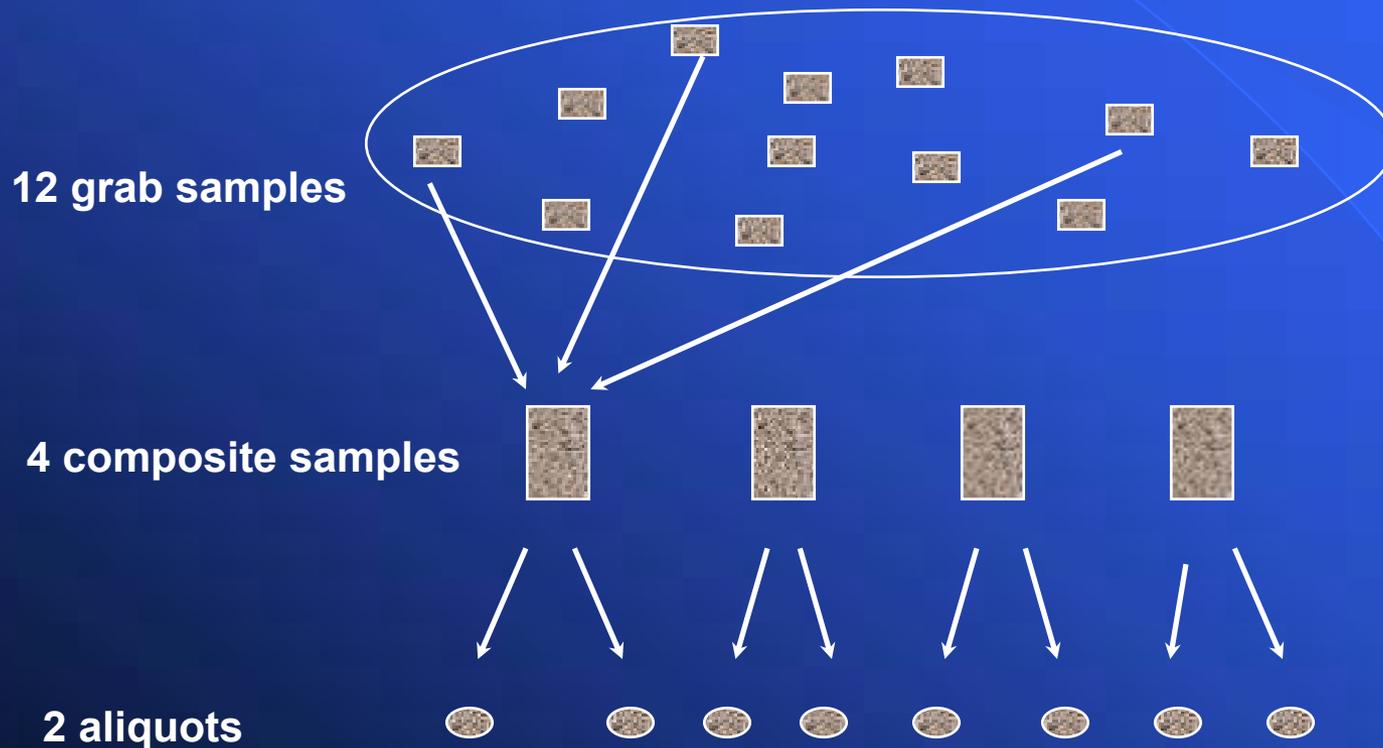
# Sample Event Planning (Cont.): Sample Uses and Data Needs

	Sample Uses	Data Needs
<b>Source Samples</b>	ID Haz. Subs.; Attribution; Direct Observation	Qualitative; Analyte specific
<b>Release Media Samples</b>	Observed Release; Compare to background	Quantitative; Analyte specific
<b>Background Media Samples</b>	Observed Release; Compare to release	Quantitative: Analyte specific
<b>Exposure/target Samples</b>	Compare to benchmarks	Quantitative; Analyte specific
<b>Attribution Samples</b>	Rule out other possible sources of media contam.	Qualitative; Analyte specific

# Sample Event Planning (Cont.): Number, Types and Locations of Samples

- The number of each type of sample will depend on sample uses and data needs.
- Sample locations are critical in the HRS conceptual site model.
- Map general sample locations, but select specific locations based on field evidence.
- Watch for impromptu sampling opportunities.

# Sample Event Planning (Cont.): Grab vs. Composite Sampling



# Sample Event Planning (Cont.): Sampling Designs

## ■ Judgmental (biased) sampling

- Sampling locations are selected based on site history, operation, and other knowledge
- Focuses on grab samples and locations
- Presents a “worst case scenario”
- Fewer samples collected

## ■ Probabilistic sampling

- Sampling locations are chosen randomly/set pattern
- Focuses on characterizing contamination extent
- Can do conventional statistical analysis; the type of analysis depends on design
- More samples collected

# Sample Event Planning (Cont.): Method Selection

- Select methods that meet your data needs, considering: sensitivity, analyte specificity, cost, target matrix.
- In general, conduct full spectrum analysis on fixed lab samples.
- Specify sampling and analysis methods to be used in the field.

# Sample Event Planning (Cont.): Field & Fixed Lab Data

- A common myth is that only fixed labs can produce quantitative data and that field methods only produce qualitative data.
- As technologies evolve, collecting field data is becoming more and more essential to a sampling event's success.
- Samples requiring complex extractions or analytical procedures might best be sent to fixed labs.

# Sample Event Planning (Conc.): SOPs

- Standard operating procedures (SOPs) should be followed and included as attachments to sampling work plans.
- Deviating from SOPs could result in unusable data, if not justified and well documented.
- Ensure that regional sampling guidance is followed.

# Sample Collection

- Use your field logbook – document measurements, sample characteristics, sample locations, sampling times/dates, weather, etc.
- Missing logbook documentation can jeopardize sample usability
- Field logbooks are primary references that the court looks to for evidence of work plan compliance and deviations.

# Sample Collection (Cont.): Dynamic Field Activities

- Field analytical tools and decisionmaking can reduce mobilizations, produce more defensible data/decisions, and save money and time.
- The work plan should be written to accommodate changes in approach due to unexpected field analytical results.
- For more information see OERR's dynamic field activities web site at <http://www.epa.gov/superfund/programs/dfa/index.htm>.

# Sample Collection Discussion: Direct Push Ground Water Access

- Use direct push (DP) ground water access technologies, where appropriate, to document aquifer observed releases.
- Ensure comparability between DP samples.
- Better for organics than metals.
- Use DP to attribute contamination between monitoring/drinking water wells.



# Sample Collection (Cont.): Field Sample Analysis

- Use real-time instruments to get qualitative and quantitative results.
- Field analysis should be used to identify the best location for fixed lab sample collection.
- Specify instruments, methods, QC procedures, and intended use of the sample.

# Sample Collection (Cont.): Source Sampling

- Qualitative data will likely suffice, unless comparison to background is necessary.
- Field-based analytical data are ideal for source samples, as precise concentrations are not required.
- Source samples should be representative of the waste in the source.



# Sample Collection (Cont.): Observed Release Sampling

- Quantitative data are required for chemical analysis observed release (OR), qualitative may suffice for direct observation OR.
- Field-based analytical may be used, but known concentrations are required for chemical analysis OR.
- Samples need to represent a point within the pathway media.
- Background data necessary, unless direct observation.



# Sample Collection (Cont.): Ground Water Pathway

- Consider using direct push technologies, where appropriate, to establish ground water releases.
- For sites with many wells, consider using field analysis to screen background and release wells.
- Note the casing elevation and the total well depth in your field logbook.
- Ensure background and release samples are from the same part of the same aquifer.

# Sample Collection (Cont.): Surface Water Pathway

- Collect comparable samples for each media.
- Carefully document sample locations and physical characteristics in your logbook.
- Use more than one rationale to attribute hazardous substances to the site.
- Consider target locations when identifying sample locations.

# Sample Collection (Cont.): Air Pathway

- Make sure that the sampling volume is similar for each sampling station.
- Do not introduce air contamination by working while air samples are being collected.
- Collect accurate meteorological data while air samples are being collected.

# **Sample Collection (Concluded): Soil Exposure Pathway**

- Avoid using composite samples to establish observed contamination.
- Quantitative data are required to establish observed contamination.
- Combine source and observed contamination samples, if scoring a migration pathway.

# Keep Focused

- **Know the minimum data you need to still make your decision.**
- **Identify and ensure that “critical samples” are collected.**
- **Deviate from your sampling plan if it will increase the likelihood of success, but always document deviations.**

# Exercise 3

**Expect the Unexpected**

# Module 5

## Reviewing Analytical Data

# Indicators of Analytical Data Problems

- The following quality control parameters provide information about analytical data quality:
  - Holding Times
  - Calibration
  - Blanks
  - Lab QC Samples
  - MS/MSD
  - Surrogates
  - Duplicates

**Note:** It is critical to have the documentation (as relevant) for these parameters when evaluating data quality.

# Holding Times

- Applies to both organic and inorganic data.
- Can result in low bias.
- Data may be qualified J or UJ.

# Calibration

- Applies to organic and inorganic data.
- Can result in low, high or unknown bias.
- Data may be qualified J or UJ.

# Blanks

- Applies to organic and inorganic data.
- Can result in low or high bias.
- Data may be qualified U or UJ.

# Laboratory Control Samples

- Applies to organic and inorganic data.
- Can result in low or high bias.
- Data may be qualified J.

# Matrix Spike/Matrix Spike Duplicates

- Applies to organic and inorganic data.
- Can result in low, high or unknown bias.
- Data may be qualified J or UJ.

# Surrogates

- Applies to organic data.
- Can result in low or high bias.
- Data may be qualified J or UJ.

# Duplicates

- Applies to inorganic data (primarily).
- Can result in unknown bias.
- Data may be qualified J.
- Includes laboratory and field duplicates.

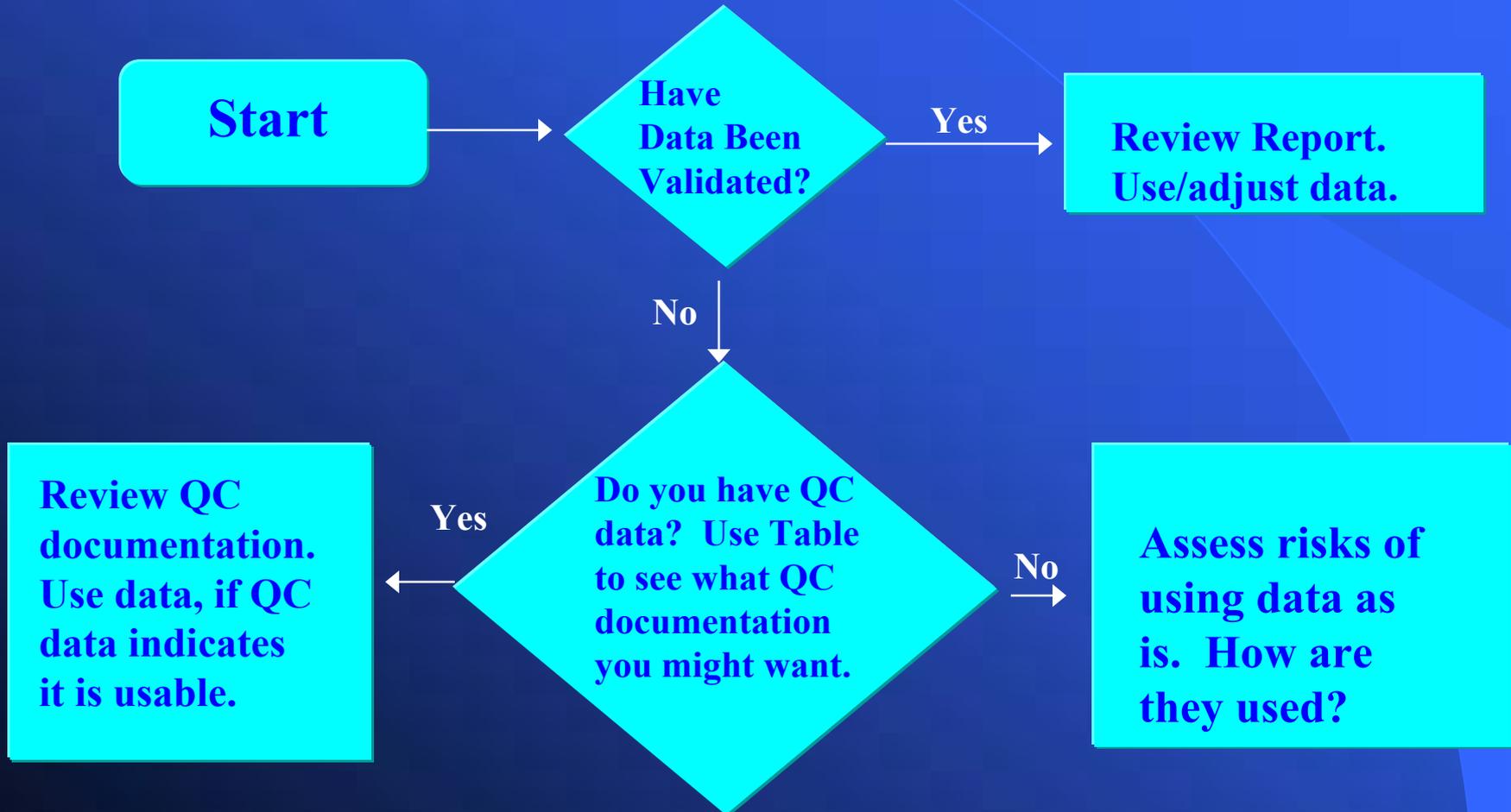
# Questions that Affect Usability for HRS Scoring

1. Who collected the data and why?
2. What was the intended use of the data?
3. Can the data be used for the purpose for which it was intended?

# Questions that Affect Usability for HRS Scoring

4. Does it support or contradict other known data?
5. Have the data been reviewed or validated?
6. Are the data qualified or biased?

# Data Decision Tree



# Discussion

## Review a Validated Data Package

# Exercise 4

## Reviewing Unvalidated Data

# Module 6

## Using Qualified Data

# Use of Qualified Data in Site Assessment and HRS

- Qualified data are often of sufficiently known and documented quality, and may be used in establishing an observed release and observed contamination.
- EPA Fact Sheet - “Using Qualified Data to Document an Observed Release and Observed Contamination” Nov. 1996
  - Use the fact sheet for SA generated data (CLP or equivalent)

# Qualified Data

- **J - Can result in low, high or unknown bias.**
- **UJ - Can only be used when there is confidence that the background concentration is not above the CRQL, the background concentration is biased high, and the release concentration equals or exceeds the CRQL.**

# Use of Adjustment Factors Background Samples

No Bias - Use concentration without adjustment

Low Bias - Multiply concentration by factor

High Bias - Use concentration without adjustment

Unknown Bias - Multiply concentration by factor

# Use of Adjustment Factors Release Samples

No Bias - Use concentration without adjustment

Low Bias - Use concentration without adjustment

High Bias - Divide concentration by factor

Unknown Bias - Divide concentration by factor

# EXAMPLE

**1,1,1-Trichloroethane (1,1,1 TCA)**

**Background – 10 J (low bias)**

**Release – 1000 J (high bias)**

**Adjustment factor – 10 (per fact sheet)**

**Is an observed release established?**

# Issues with Using Adjustment Factors

- The use of an adjustment factor should only be considered as a management tool that provides a quick screening for site assessment.
- Application of adjustment factors are intended for use with qualified data reported at or above the SQL.

# Summary

- Do I have the data that I need to make a decision?
- Do I have a site score of 28.5 or greater?
- Do I need to collect more data?

# Exercise 5

## Data Assessment and Usability