Data Quality Assessment and Data Usability Evaluation

Presented by the DEEP QA Workgroup

May 8, 2025

DQA/DUE Outline

Introduction to QA/QC Concepts

- Scientific method
- Data quality objectives
- Data quality and usability concepts

Understanding Environmental Data

- Quality assurance
- Data quality indicators
- PARCCS (precision, accuracy, etc.)

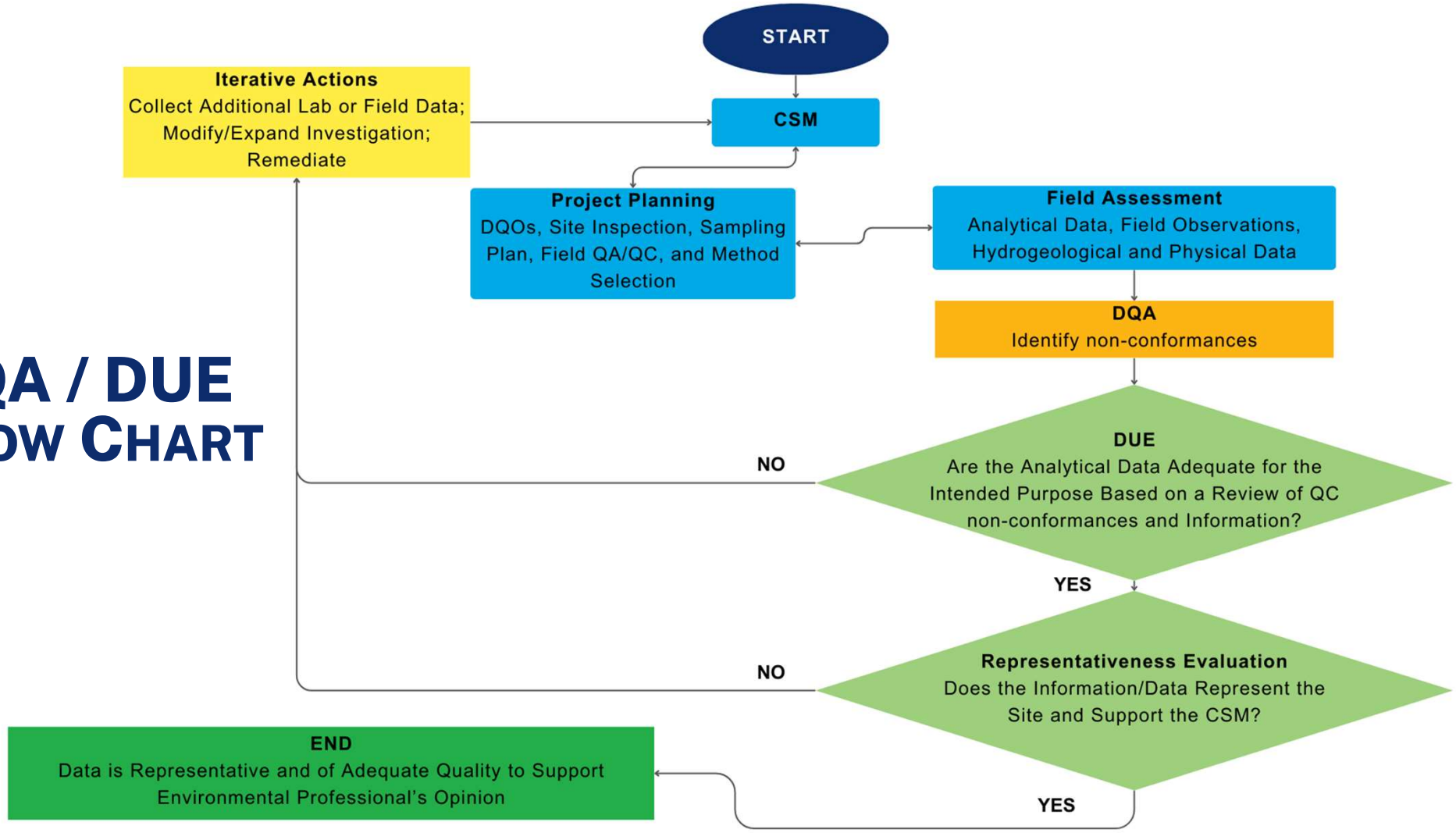
Data Quality Assessment and Useability

- Data quality assessment (DQA) process
- Data usability evaluation (DUE) process

Documenting Data Usability

- How to document DQA/DUE
- Common documentation problems
- Documentation tips

DQA / DUE Flow Chart



Introduction to QA/QC Concepts

- ***The Basics of DQA/DUE***
- ***Reasonable Confidence Protocols***

Presented by:

Roni Tanguay
DEEP | Remediation Division

Kevin Vanderveer
DEEP | Remediation Division

Section Outline

Introduction to QA/QC Concepts

The Scientific Method	How it relates to environmental cleanup Importance of understanding Data Quality
Data Quality Objectives (DQOs)	Examples of DQOs to consider
Data Quality Assessment (DQA)	Reasonable Confidence Laboratory Narrative Chain of Custody
Data Usability Evaluation (DUE)	Review of Laboratory QA/QC & Narratives Types of Analytical Data
Roles & Responsibilities	Environmental Professionals' Responsibilities Laboratories' responsibilities

The Scientific method

1. **Identify the problem**
   - Do I have release?
   - I have a release. How bad is it?
2. **Construct Conceptual Site Model**
   - What is already known?
   - Conduct background research
3. **Experiment Design**
   - Work plan
   - Data Quality Objectives (DQOs)
4. **Data Collection**
   - Field activities
   - Laboratory analysis
5. **Data Analysis**
   - DQA/DUE
   - Interpretation of field and laboratory data
6. **Conclusion**

Why is it Important to Understand Laboratory QA/QC?

- **All data has some degree of qualitative & quantitative uncertainty**
- **Decision-making using the Conceptual Site Modeling (CSM)**
  - Investigation planning
  - Determining compliance with regulatory standards
  - Remediation design
- **Setting data quality objectives (DQOs)**
  - Laboratory reporting limits/lower limits of quantitation (RL/LLOQs)
  - Analytical method capabilities
  - Receptors
    - Drinking water
    - Ecological Thresholds
  - Attainability of project-specific goals
- **QA Plan**
  - Field & lab procedures designed to meet DQOs
- **Evaluating DQOs**
  - Data quality assessment
  - Data usability evaluation

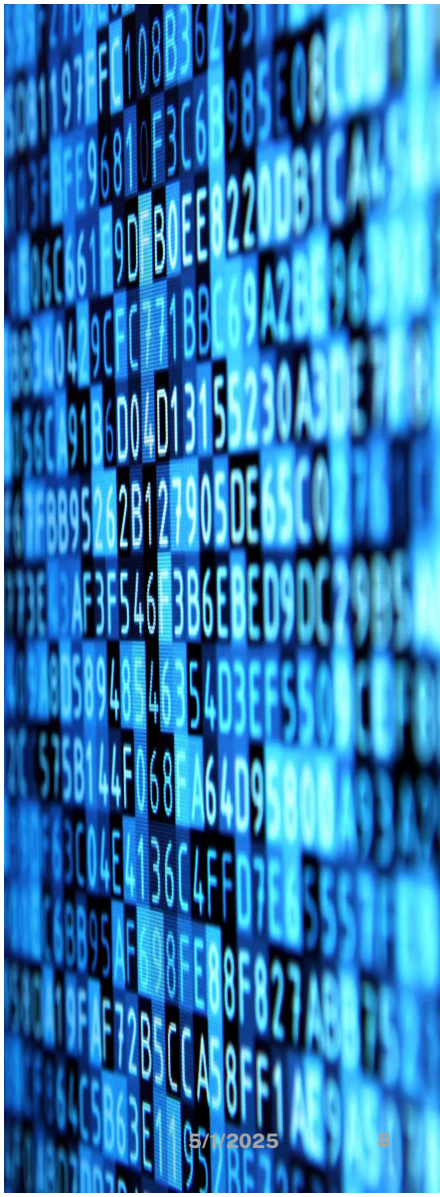
Data Quality Objectives (DQOs)

DQOs are goals **specific to the investigation** to help ensure that a sufficient quality and quantity of data are collected to **achieve** the investigation **objectives** and **support conclusions**.

For example, the **type of data** needed for **characterization** may be **different** than the data needed for **demonstrating compliance**.

Example DQO Questions:

- What are the constituents of concern?
- What locations are most likely to be impacted by a release?
- What types of samples are needed (soil, groundwater, surface water, air, sediment, etc.)?
- How many samples are needed?
- What sample distribution is needed?
- Is background sampling needed?
- What sampling methods are appropriate to obtain the necessary data?
- What analytical methods are appropriate?
- What reporting limits are needed?



Data Quality Assessment and Data Usability Evaluation

Purpose

- ✓ Provides confidence that the laboratory analytical data is of sufficient quality to support the decisions being made
- ✓ Provides an accurate and consistent means to assess environmental impacts to land, water and human health
- ✓ Reduces uncertainty (human health risks, and financial and environmental uncertainty)

Process

1st step is Data Quality Assessment (DQA)

- ➢ Identify and summarize QC nonconformances

2nd step is Data Usability Evaluation (DUE)

- ➢ Determine whether or not the quality of the data is sufficient for the intended purpose

Data Quality Assessment

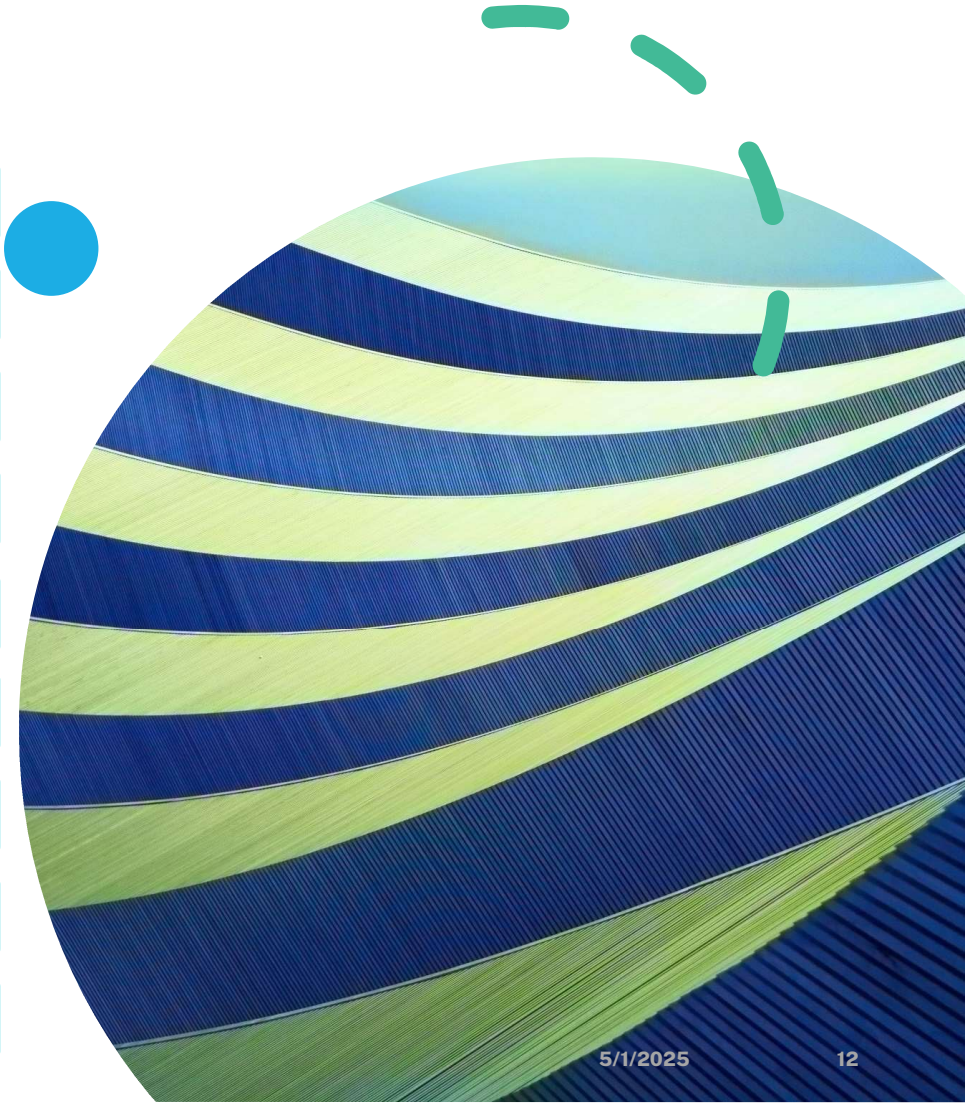
- **The process of identifying and summarizing any quality control deviations that occurred throughout sampling and analytical processes**
  - Documentation of Reasonable Confidence, Laboratory Certification Form
  - Laboratory Narrative, narrating non-conformances
  - Review of data compared with the Chain of Custody
- **The DQA should be performed throughout the course of the project**
  - Collecting appropriate QA/QC samples in the field
  - Reviewing field data/notes for potential issues
  - After receipt of each laboratory report to ensure any re-analysis of any samples can be conducted within the hold time
- **The DQA must be performed prior to the DUE**

Reasonable Confidence

- **Analytical data used for environmental investigation and remediation projects must be of a known and sufficient level of quality**
- **DEEP has established the concept of "Reasonable Confidence" and developed the Reasonable Confidence Protocols (RCPs) to standardize the following:**
  - Quality Assurance/Quality Control (QA/QC)
  - Analytical laboratory data reporting
- **"Reasonable Confidence" is achieved when:**
  - The laboratory has followed the Reasonable Confidence Protocols (RCPs)
  - Non-conformances, if any, have been narrated
  - Environmental Professional (EP) has adequate information to make judgments regarding data quality and data usability for the intended purpose

What information is in the RCPs?

Overview of the method	Summary of the analytical method
Method Interferences	
QC Requirements	Table 1A – Specific QA/QC Performance Requirements
Special Analytical Considerations	
Analyte List	Table 1B
Routine Reporting Deliverables	
Sample Containers, Preservations, Holding Times	
Tentatively Identified Compounds (TICs)	
Appendices	



Which RCPs were Updated in 2024?

QR code to DEEP QA webpage

NOTE!

- RCP TO-15 has not been updated *yet*, but it will be in the future
- RCP 1633 coming in the future
- RCP 8021 has been retired

Metals

- 6010 – Metals by ICP-OES
- 6020 – Metals by ICP/MS
- 7000/7010 – Metals by GFAA/FLAA
- 7196 – Hexavalent Chromium by spectrophotometry
- 7470/7471 – Mercury by CVAA

Other

- 9010/9012/9014 – Cyanide by distillation and colorimetry

Organics

- 8081 – Pesticides by GC
- 8082 – PCBs by GC
- 8151 – Herbicides by GC
- 8260 – VOCs by GC/MS
- 8270 – SVOCs by GC/MS
- CT ETPH – Extractable Petroleum Hydrocarbons by GC/FID
- EPH – Extractable Petroleum Hydrocarbons by GC/FID
- APH – Air Petroleum Hydrocarbons by GC/MS
- VPH – Volatile Petroleum Hydrocarbons by GC/PID/FID
- TO-13 – PAHs in air
- TO-17 – VOCs in air

KEY RCP CONSIDERATIONS

Analyte List

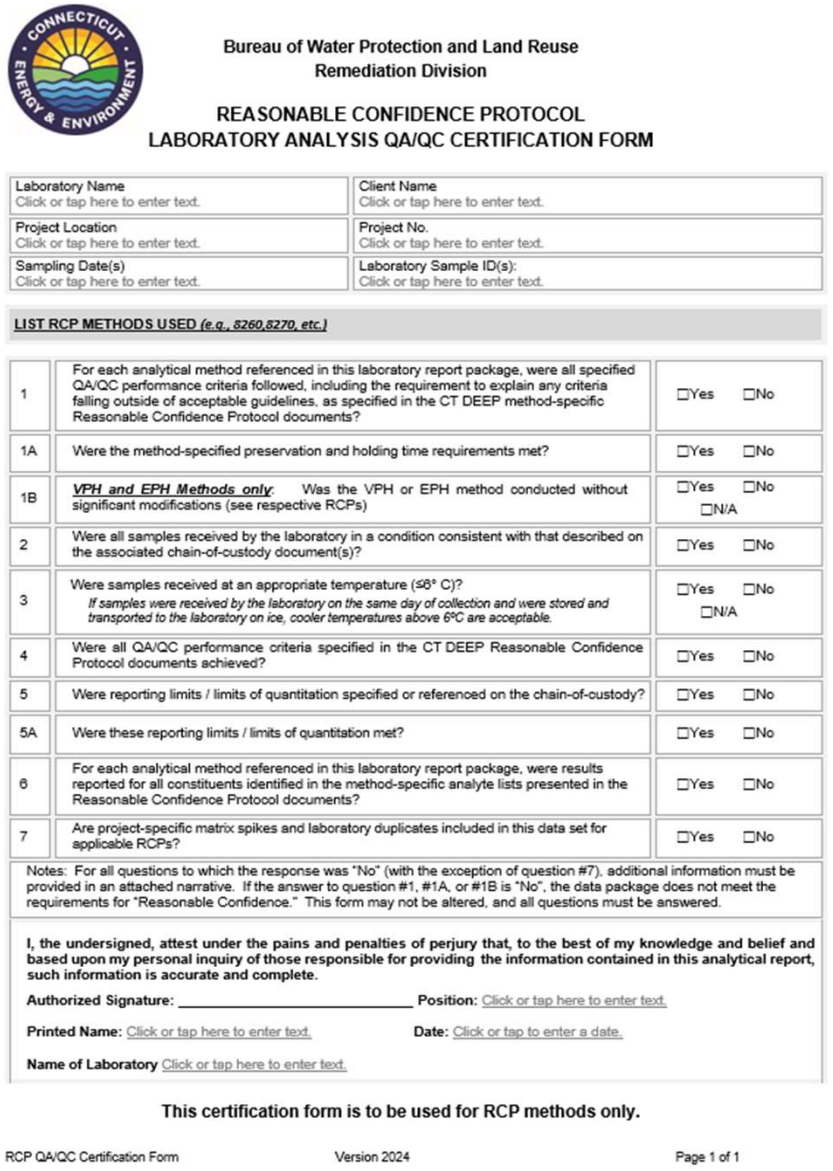
- All compounds calibrated and reported unless directed differently by the EP

Reporting Specifications

- Batch MS/MSD not reported, only report site-specific MS/MSD
  - **NOTE!** Site-specific MS/MSD now **required** for **metals** analyses in **solid** sample matrices
- Results below RL/LLOQ reported as **"ND" with the numeric RL/LLOQ value**
  - **NO** "J" flags, except for TICs in drinking water
- Specific list of report deliverables
- Soils/Sediments reported on dry weight basis

RCP Laboratory Certification Form

- Lists performance criteria for labs to certify the data meets RCPs with exceptions noted in narrative
- Requires signature
- Can't be altered
- Available on DEEP [QA/QC webpage]



Bureau of Water Protection and Land Reuse
Remediation Division

REASONABLE CONFIDENCE PROTOCOL
LABORATORY ANALYSIS QA/QC CERTIFICATION FORM

Laboratory Name Click or tap here to enter text.	Client Name Click or tap here to enter text.
Project Location Click or tap here to enter text.	Project No. Click or tap here to enter text.
Sampling Date(s) Click or tap here to enter text.	Laboratory Sample ID(s): Click or tap here to enter text.

LIST RCP METHODS USED *(e.g., 8260,8270, etc.)*

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEEP method-specific Reasonable Confidence Protocol documents?	☐Yes ☐No
1A	Were the method-specified preservation and holding time requirements met?	☐Yes ☐No
1B	***VPH and EPH Methods only***: Was the VPH or EPH method conducted without significant modifications (see respective RCPs)	☐Yes ☐No ☐N/A
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	☐Yes ☐No
3	Were samples received at an appropriate temperature (≤6° C)? *If samples were received by the laboratory on the same day of collection and were stored and transported to the laboratory on ice, cooler temperatures above 6ºC are acceptable.*	☐Yes ☐No ☐N/A
4	Were all QA/QC performance criteria specified in the CT DEEP Reasonable Confidence Protocol documents achieved?	☐Yes ☐No
5	Were reporting limits / limits of quantitation specified or referenced on the chain-of-custody?	☐Yes ☐No
5A	Were these reporting limits / limits of quantitation met?	☐Yes ☐No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the Reasonable Confidence Protocol documents?	☐Yes ☐No
7	Are project-specific matrix spikes and laboratory duplicates included in this data set for applicable RCPs?	☐Yes ☐No

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Reasonable Confidence." This form may not be altered, and all questions must be answered.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete.

Authorized Signature: _____ **Position:** Click or tap here to enter text.

Printed Name: Click or tap here to enter text. **Date:** Click or tap to enter a date.

Name of Laboratory Click or tap here to enter text.

This certification form is to be used for RCP methods only.

RCP QA/QC Certification Form Version 2024 Page 1 of 1

Laboratory Narrative

- RCPs require all reports must have a narrative
- Describe in detail all nonconformances
- Provide all samples and analytes affected
- Narratives should be sample-specific, as appropriate

Chain of Custody Forms

- Serves as the connection between the field and the laboratory
- Includes sample collection information
- Includes analytical requests
- Compare Chain of Custody with Data Report
- Contact the laboratory for help or clarification, if needed

Chain of Custody Tips

No scribbling out information, single cross-out only

- Cross-outs dated and initialed (preferred)

Relaying project requirements ahead of time

- Discussing criteria with lab before analysis
- Confirming analytes of concern
- Confirming applicable hold times
- Confirming desired turn-around times, particularly with a high volume of samples

Note if samples are preserved or kept at appropriate temperature

5/1/2025

Data Usability Evaluation

- **The process of evaluating whether the analytical data are of sufficient quality and are usable for the intended purpose within context of the DQOs and the CSM**
- **Determine if any bias and/or non-conformances identified in the DQA process affects data usability**
- **DUE parameters to consider include:**
  - Volume and representativeness of data available for the site
  - Screening-level data
  - Field observations & protocols
  - Laboratory QC including: blanks, spike recoveries, surrogate recoveries, internal standard recoveries, laboratory control sample recoveries
  - RCP conformance or non-RCP equivalency demonstration

DQA/DUE Roles & Responsibilities

Environmental Professionals

Project Planning & Sample Submittal:

- QAPP/RCPs
- Project Objectives and CSM
- Communicate with laboratory
- Provide a Chain of Custody and properly preserved samples within holding times

Upon Receiving Laboratory Report:

- Review laboratory report and non-conformances (if any)
- Communicate with lab if there are any questions

Perform/Document DQA/DUE Process:

- Review QA/QC to assess the quality of the data
- Evaluate the usability of the data
- Demonstrate and document the quality and usability of the data for reporting purposes

Laboratory

The Lab provides the EP and others with:

- Sample containers with preservative
- Sign off on Chain of Custody
- Laboratory Data with QA/QC information including laboratory narrative
- RCP Laboratory Analysis QA/QC Certification Form
- Narrative of non-conformances
- Answer questions when asked
- Maintain DPH Environmental Laboratory Certification

PROJECT PLANNING

EP RESPONSIBILITY

- **EP's responsibility for the DQA starts when designing an investigation & setting DQOs**
- **EPs should consider and communicate the following:**
  - Analytes of interest (i.e., Constituents of Concern)
  - Appropriate analytical methods
    - RCP vs Non-RCP
  - RL/LLOQs necessary to achieve intended use of the data
    - Regulatory Criteria Required
  - Turn around time needed
  - Holding times
  - QC requirements
    - Blanks, Duplicates, Matrix Spikes, etc.
  - Data Deliverables
    - Equis, Excel, Level 4, etc.
  - Containers & Preservatives
    - Sample volume needed
- **Laboratory Communication Form on the QA/QC Webpage**

Plan Ahead Tip!
Consider if samples need to be picked-up/dropped-off within specific timeframes to avoid missing holding times/temp ranges

SAMPLE ID	DEFINITION
0 Cal Std	Calibration Standard
0.1 Cal Std	“”
0.2 Cal Std	“”
0.4 Cal Std	“”
0.8 Cal Std	“”
1.6 Cal Std	“”
ICV	Initial Calibration Verification
CCB	Continuing Calibration Blank
LCS	Lab Control Sample
RL/LLOQ	Reporting Limit/Lower Limit of Quantitation
LRB	Lab Reagent Blank (separate sample from the CCB)
Sample 1	
Sample 1_MD	Laboratory Matrix Duplicate (i.e. 2nd aliquot of sample)
Sample 1_MS	Matrix Spike (i.e. 3rd aliquot of sample that has known concentration of analyte added)
Sample 2	
Sample 3	
Sample 4	
Sample 5	
Sample 6	
CCV	Continuing Calibration Verification
CCB	

Example of an Analytical “Run”

- Each of these rows represent a **“run”**
- If this were an GC/MS analysis, each row would represent **30 minutes per run**
- Totaling **11 hours** of instrument run-time for just **6 samples**! Typical batches consist of 20 field samples.
- Instruments that require long run times generally run overnight on “auto-run”
- NOTE: This is why submitting samples sufficiently **within hold times** is SO important

DATA PACKAGE REVIEW
EP RESPONSIBILITY

Upon Receiving Data Package:

- **Review Laboratory Data Package**
  - Review RCP Certification Form
    - Checking for “no” boxes & narrations of non-conformance if applicable
  - Review Narrative for the non-conformances
  - Review Chain of Custody compared to laboratory report to ensure all requested analyses/analytes completed and reported
- **Review and evaluate the laboratory data and non-conformances (if any)**
- **Communicate with laboratory if there are any questions**
- **Conduct review ASAP to allow lab to conduct re-analysis within holding times**

PERFORMING DQA/DUE REVIEW & DOCUMENTATION

EP RESPONSIBILITY

- **Review QA/QC to assess quality of the data**
  - Review laboratory data with respect to the established DQOs
    - Consider criteria required
    - Intended use of the data for the project (i.e., SEH certification, Verifications, RCRA CA milestones, screening, etc.)
  - Review the lab narrative and non-conformances (if any)
- **Evaluate the usability of the data**
  - Consider DQOs
  - Consider lab data in relation to field data
    - Sample heterogeneity
    - Sample composition, is it representative of target?
    - Field measurement discrepancies
- **Demonstrate and document the quality and usability of the data for reporting purposes**
  - Evaluate and demonstrate quality and usability of non-RCP data
  - Narrate how the data supports the CSM and DQOs
    - Be concise and attached supporting information as needed

Types of Analytical Data

TYPE OF DATA	DESCRIPTION	DATA QUALITY ASSESSMENT
RCP Data	Analytical data generated using the RCPs	Evaluate precision, accuracy, and sensitivity[1]
Non-RCP Data (existing RCP)	Analytical data generated from samples collected after September 1, 2007, using a non-RCP method where there is an existing RCP	RCP Equivalency Demonstration Form[2] required to demonstrate EP evaluated precision, accuracy, and sensitivity
Non-RCP Data (no RCP)	Analytical data generated using a method for samples collected after September 1, 2007, with no corresponding RCP	Evaluate precision, accuracy, and sensitivity using QC data equivalent to a similar RCP
Pre-RCP Data	Analytical data generated prior to September 1, 2007, that were generated using a method without a corresponding RCP	Use existing QC data to evaluate precision, accuracy, and sensitivity. If precision and accuracy QC data are not available, evaluate sensitivity

[1]RCSA 22a-133k(1)(h)(1)
[2]Equivalency demonstration form is available on the DEEP QA/QC Webpage

DQA/DUE Basics Summary

The Scientific Method	**How it relates to environmental cleanup** **Importance of understanding Data Quality**
Data Quality Objectives (DQOs)	**Examples of DQOs to consider**
Data Quality Assessment (DQA)	**Reasonable Confidence** **Laboratory Narrative** **Chain of Custody**
Data Usability Evaluation (DUE)	**Review of Laboratory QA/QC & Narratives** **Types of Analytical Data**
Roles & Responsibilities	**Environmental Professionals' Responsibilities** **Laboratories' responsibilities**

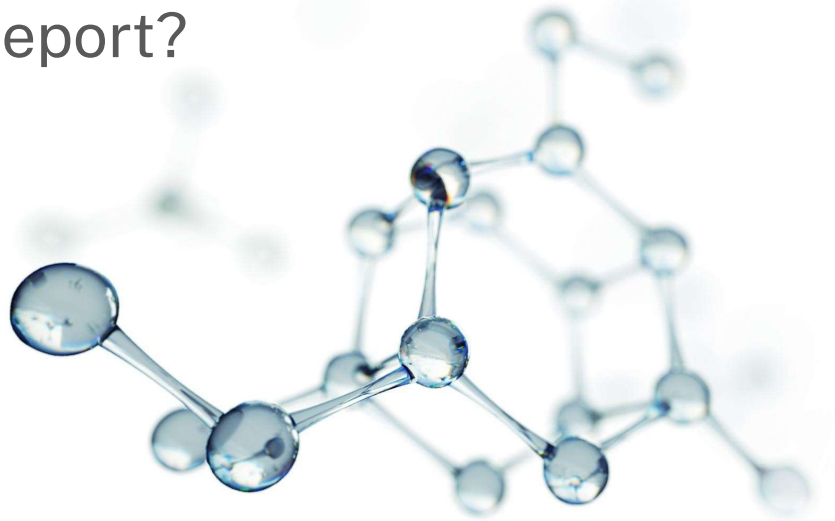
QUIZ BREAK

Introduction to QA/QC Concepts

Poll Q1-RCP QA/QC Certification Form

Does the laboratory need to know that your project needs to meet CT RCP guidance and that the QA/QC Certification Form needs to be included with your report?

a. Yes
b. No
c. It depends



Q1-Chain-of-Custody

- What information needs to match on your chain-of-custody and on your sample labels? (select all that apply)
  - ☑ a. Sample ID
  - ☐ b. Analysis
  - ☑ c. Collection Date
  - ☐ d. Regulatory criteria
  - ☑ e. Collection Time
  - ☑ f. Preservative
  - ☐ g. Project Name/Site Location

Q2-Chain-of-Custody

- Do you need to be specific with the methods you are requesting?
  a. Yes
  b. No
  c. It depends

QUESTIONS?

Please type your Questions into the Q&A Box

Overview of Environmental Analysis

➢ ***Understanding Analytical Data and Basic Data Quality Indicators***

Presented by:

Rebecca Merz
Phoenix Laboratories

Jeffrey Smith
CET Labs

Roni Tanguay
DEEP | Remediation Division

Kevin Vanderveer
DEEP | Remediation Division

Section Outline

Understanding Environmental Analytical Data and Data Quality Indicators

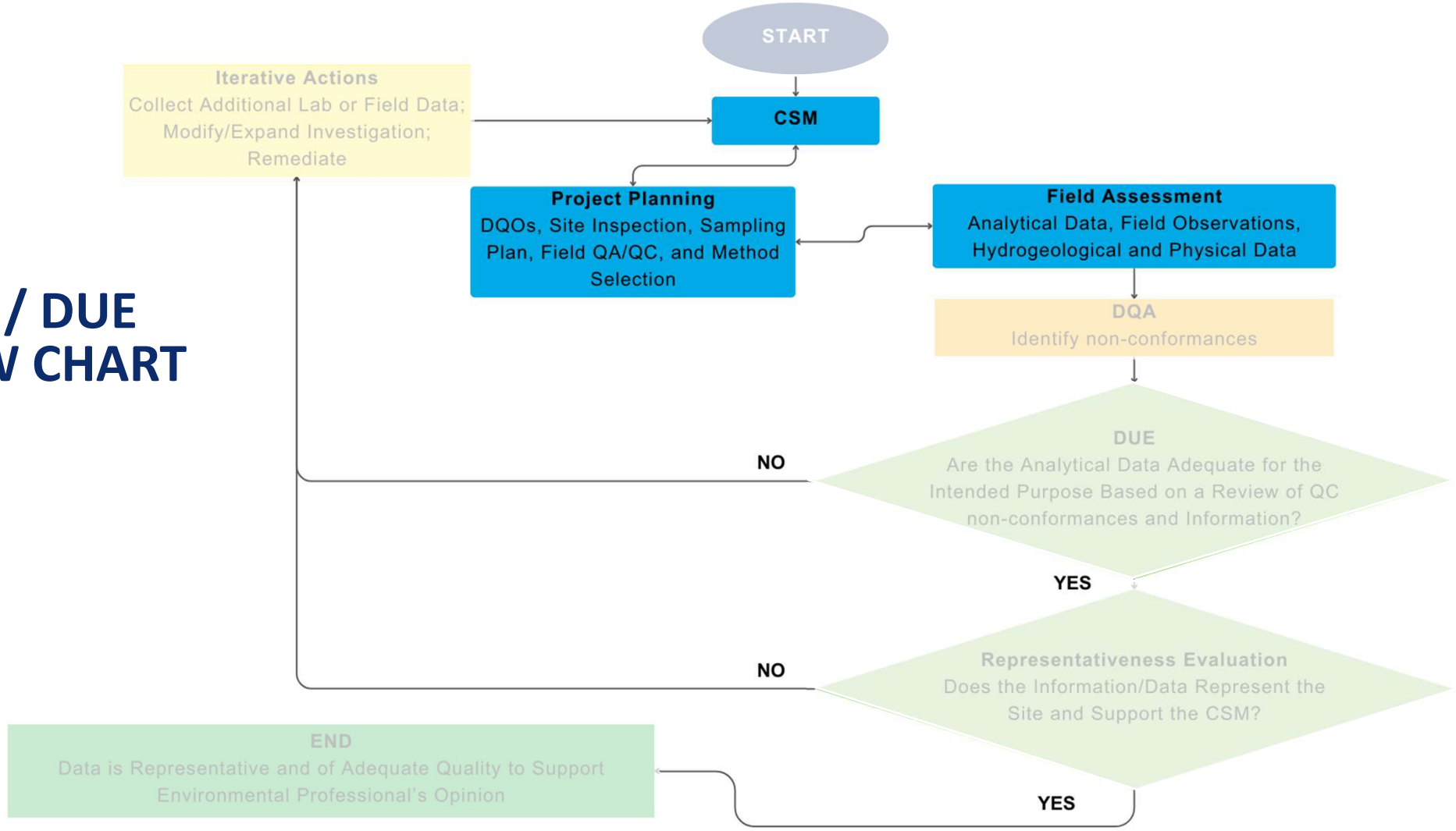
Quality Assurance

- Acronym Soup
- What Defines a Quality Assurance Program

PARCCS

- Precision
- Accuracy
- Representativeness
- Comparability
- Completeness
- Sensitivity

DQA / DUE FLOW CHART



QA Alphabet Soup

- BS/BSD – Blank Spike / Blank Spike Duplicate (aka LCS)
- CCV – Continuing Calibration Verification
- CCB – Continuing Calibration Blank
- DUP – Laboratory Duplicate
- ICAL – Initial Calibration
- ICV – Initial Calibration Verification
- LCS/LCSD – Lab Control Sample / Lab Control Sample Duplicate (aka Lab Control Spike)
- LFB – Lab fortified blank (aka LCS)
- LLOQ – Lower Limit of Quantitation (aka RL)
- LRB - Lab reagent blank
- MB – Method blank
- MDL – Method Detection Limit
- MS/MSD – Matrix spike / Matrix Spike Duplicate
- RL – Reporting Limit (aka LLOQ)
- RPD – Relative Percent Difference
- QAPP – Quality Assurance Project Plan
- SOP – Standard Operating Procedure

What Defines a Quality Assurance Program?

Quality Assurance

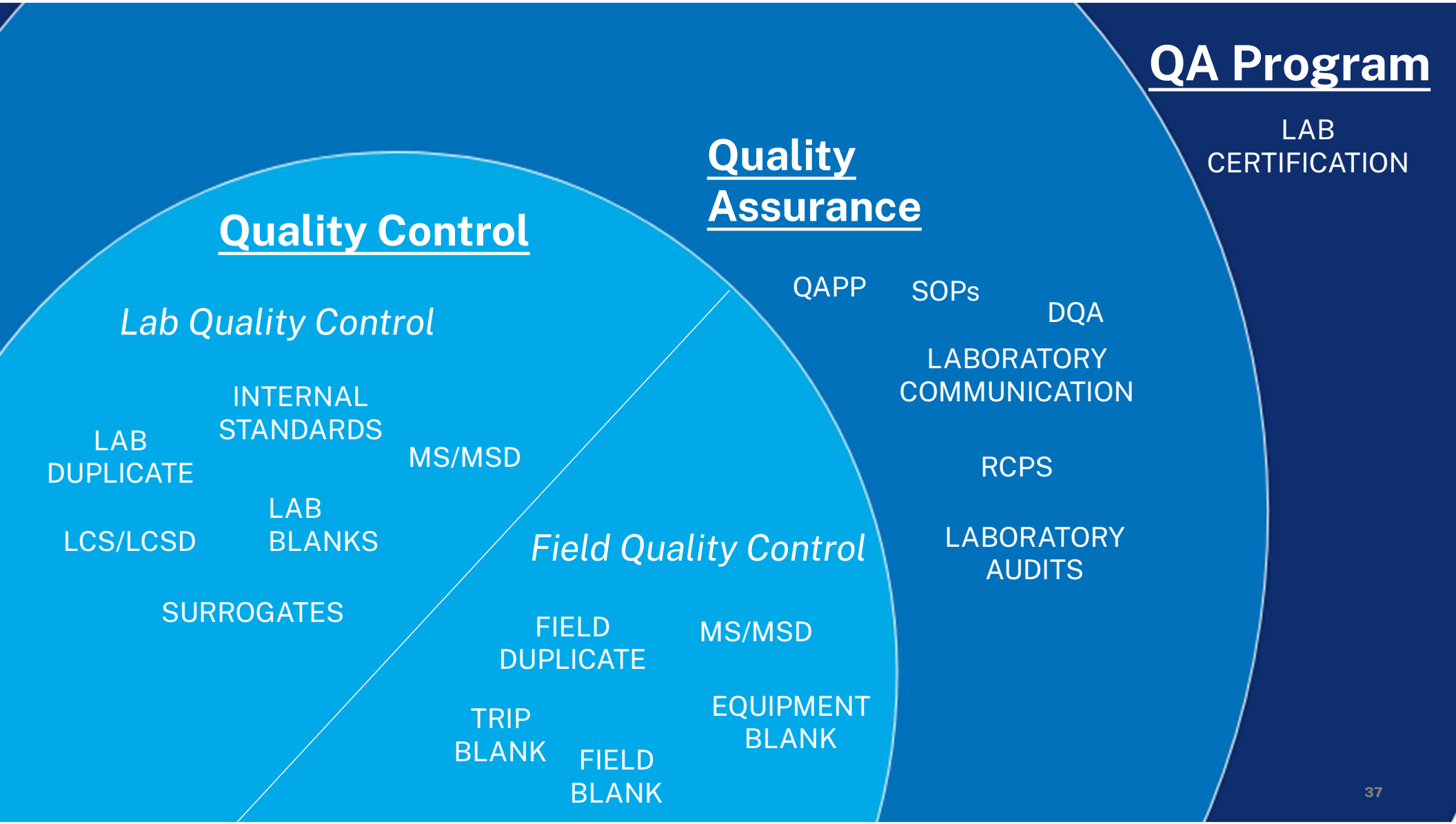
- Involves planning, implementation, assessment, reporting, and quality improvement to establish the reliability of laboratory data

Quality Control

- The specific tools that are used to achieve this reliability. QC procedures measure the performance of an analytical method in relation to the QC criteria specified in the analytical method. QC information documents the quality of the analytical data.

Together, **QA & QC** processes create a "**QA Program**" to produce data of a "**known quality**"

What do we mean by "known quality" and how do we evaluate it?


QA Program
LAB CERTIFICATION
Quality Assurance
QAPP
SOPs
DQA
LABORATORY COMMUNICATION
RCPS
LABORATORY AUDITS
Quality Control
Lab Quality Control
INTERNAL STANDARDS
LAB DUPLICATE
MS/MSD
LAB BLANKS
LCS/LCSD
SURROGATES
Field Quality Control
FIELD DUPLICATE
MS/MSD
EQUIPMENT BLANK
TRIP BLANK
FIELD BLANK

Quality Control Begins in the Field

Propagation of Error	Errors made in the field compound through entire analytical process
Labeling	Mix-ups in sample labels Illegible labels Damaged labels
Temperature	Sample not properly transported on ice No blue packs!
Holding Time	Samples sent to lab close to holding time or past holding time
Sampling Issues	Issues with low flow pump Cross-contamination avoidance Field equipment calibrations Mis-locating samples

DATA QUALITY INDICATORS

- **P**recision
- **A**ccuracy
- **R**epresentativeness
- **C**omparability
- **C**ompleteness
- **S**ensitivity

PARCCS parameters can be used to examine the quality of measurements, as well as the quality of sampling efforts

Key Point! Although frequently used to develop QA plans, PARCCS parameters are *NOT* DQOs

Qualitative vs Quantitative

PARCCS are quantitative and qualitative measures of principal quality attributes

Quantitatively

Precision, Accuracy, and Sensitivity

Qualitatively

Representativeness, Comparability, and Completeness

Lab & Field Measurements

Appendix B-1
DQA/DUE Guidance Document, Ver. 2024

Appendix B-1
Types of Information Used to Evaluate Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity

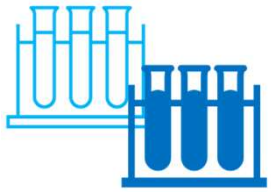
QC Element	Laboratory Measures	Field Measures
Precision	Laboratory Control Samples	Field Duplicates
	Laboratory Control Sample Duplicates	Matrix Spike Duplicates (collect samples for)
	Matrix Spike Duplicates	Matrix Duplicates (collect samples for)
	Historical Data Trends	Appropriate Sampling Procedure
Accuracy	Laboratory Control Samples	Matrix Spikes/Matrix Spike Duplicates (collect samples for)
	Matrix Spikes/Matrix Spike Duplicates	Inclusion of "Blind" Samples
	Internal Standards	Appropriate Sampling Procedures
	Surrogate Recovery	Appropriate Sample Containers
	Initial Calibration	Appropriate Sample Preservation
	Continuing Calibration	Holding Times
	Standard Reference Material	Equipment Blank/Field Blank
Representativeness	Laboratory Homogenization	Appropriate Sampling Procedures Appropriate Sample Containers
	Appropriate Sub-sampling	Appropriate Sample Preservation
	Appropriate Dilutions	Incorporation of Field Screening Data
	"As Received" Sample Preservation Meeting Hold Times	Appropriate Number of Samples
Comparability	Gas Chromatography/Mass Spectrometry Tuning	Comparison to Previous Data Points
	Calibration	Comparison to Similar Data Points
	Analytical Method Followed	
Completeness	Percent Sample Per Batch Analyzed and Reported	Percent Planned Samples Collected
	All Critical Samples Reported and Unqualified	All Critical Samples Collected
Sensitivity	Method Blanks	Equipment Blank/Field Blanks
	Instrument Blanks	Appropriate Sample Volume or Weight
	Reporting Limit (Lowest Calibration Standard)	
	Appropriate Analytical Method	

Adapted from Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup, *MCP Representativeness Evaluations and Data Usability Assessments, Policy #WSC-07-350*, September 19, 2007.

PRECISION

A concept used to describe the dispersion, or closeness, of a set of measured values

PRECISION – EXPRESSION OF REPRODUCIBILITY & VARIABILITY



LAB GENERATED PRECISION

LCS/LCSD

- Two aliquots prepped & analyzed with samples

Batch Lab Duplicate

- Randomly selected by lab analyst
- Only applies to site-specific sample

Batch MS/MSD

- Randomly selected by lab analyst
- Only apply to the site-specific sample selected; doesn't provide precision/accuracy for every sample in the batch

FIELD GENERATED PRECISION

Field Duplicates

- Submit "blind"
- Provides precision for the specific site
- Measure of field sampling and lab precision

Site-specific MS/MSD

- Provides precision for the specific site

Calculating Precision – Relative Percent Difference

Relative Percent Difference (%RPD)

- May indicate sample heterogeneity or instrument variability

Replicate analyses

- Laboratory duplicates
- Field duplicates
- AKA Matrix duplicates (MD)

Used to assess/observe precision of measurements

- **Calculated using equation:**

$$\%RPD = \left[\frac{|R_1 - R_2|}{(R_1 + R_2)/2}\right] \times 100$$

  - R_1 = Response for sample 1
  - R_2 = Response for sample 2
  - %RPD = Relative Percent Difference

Assessing Precision

Scenario	R_1	R_2	%RPD	Acceptance Criteria (%RPD Upper Limit) lab/gw/soil
A	15	17	13	20/30/50
B	14	20	35	20/30/50

- **%RPD acceptance criteria represents an upper limit to allow variability between replicates**
  - Greater RPD, more variability, less precise
- **How would you assess the results from both scenarios?**
  - **Scenario A**
    - The RPD (precision) is within the acceptable range if the samples were lab duplicates or field duplicates
  - **Scenario B**
    - The RPD (precision) is outside the acceptable range for lab duplicates or gw field duplicates, but would be acceptable for soil field duplicates

EVALUATING PRECISION INFORMATION

Sources of Variability

1. **Measurement of system performance (lab & field)**
   - Reproducibility issues, i.e., RPDs outside of criteria
   - Sampling techniques/methods
   - Instrument variability
2. **Sample heterogeneity, media variability (field)**
   - Representativeness issues, i.e., sampling locations, etc.
   - Matrix variability, i.e., sample heterogeneity, soil variability throughout site, etc.
   - Field sampling techniques
   - Lab preparation

Evaluating Field & Lab RPDs

- **Conservative approach use > result**
- **Are the results representative of conditions of the site?**

Evaluating Precision

Scenario	R_1	R_2	%RPD	Acceptance Criteria (%RPD Upper Limit) lab/gw/soil
A	15	17	13	20/30/50
B	14	20	35	20/30/50

- **How would you evaluate the quality of the data in either Scenario A or Scenario B based on the RPDs?**
- **Scenario A**
  - Lab Duplicate (20%)
    - RPD is within acceptable range indicating acceptable instrument variability
  - Field Duplicate (30/50%)
    - RPD is within acceptable range for both gw and soil indicating acceptable sampling reproducibility and/or sample homogeneity
- **Scenario B**
  - Lab Duplicate (20%)
    - RPD is outside acceptable range indicating a lack of instrument precision
  - Field Duplicate (30/50%)
    - RPD is outside of acceptable range indicating a lack of sampling reproducibility and/or sample heterogeneity

PRECISION EXAMPLE

VOC LCS/LCSD

Serial_No:11201417:28

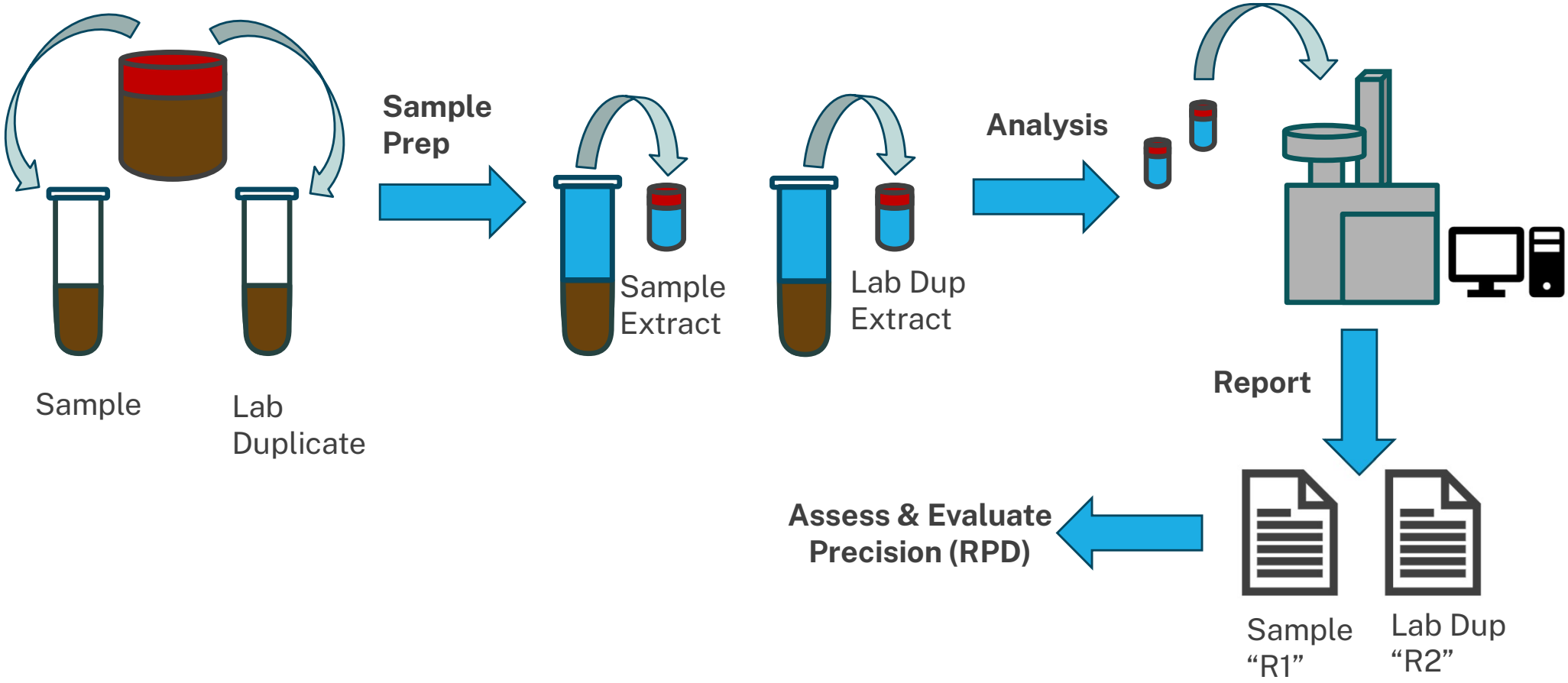
Lab Control Sample Analysis
Batch Quality Control

Project Name: TRUCK MAINTENANCE FACILITY
Project Number: CS-002

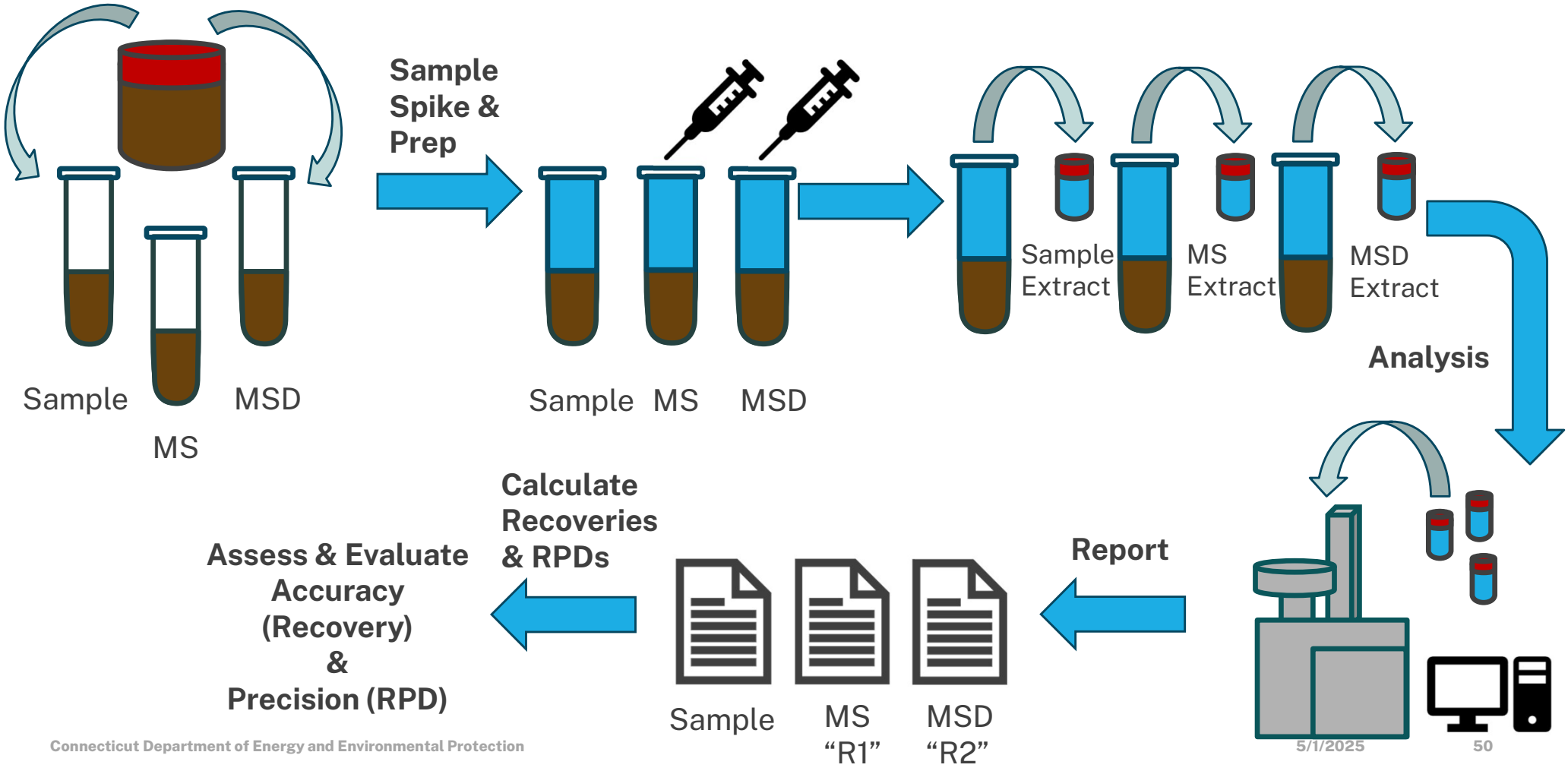
Lab Number: L1425103
Report Date: 11/20/14

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab	Associated sample(s): 01-02,07		Batch: WG737012-1		WG737012-2			
Toluene	96		95		70-130	1		20
Ethylbenzene	95		95		70-130	0		20
Chloromethane	93		93		40-160	0		20
Bromomethane	106		108		40-160	2		20
Vinyl chloride	91		91		70-130	0		20
Chloroethane	99		100		40-160	1		20
1,1-Dichloroethene	91		91		70-130	0		20
trans-1,2-Dichloroethene	94		96		70-130	2		20
Trichloroethene	47	Q	98		70-130	70	Q	20
1,2-Dichlorobenzene	97		97		70-130	0		20
1,3-Dichlorobenzene	98		98		70-130	0		20
1,4-Dichlorobenzene	96		96		70-130	0		20
Methyl tert butyl ether	99		101		70-130	2		20
p/m-Xylene	95		95		70-130	0		20
o-Xylene	96		97		70-130	1		20
cis-1,2-Dichloroethene	96		99		70-130	3		20
Styrene	95		96		40-160	1		20
Dichlorodifluoromethane	169	Q	164	Q	40-160	3		20
Acetone	61		59		40-160	3		20
Carbon disulfide	89		90		40-160	1		20

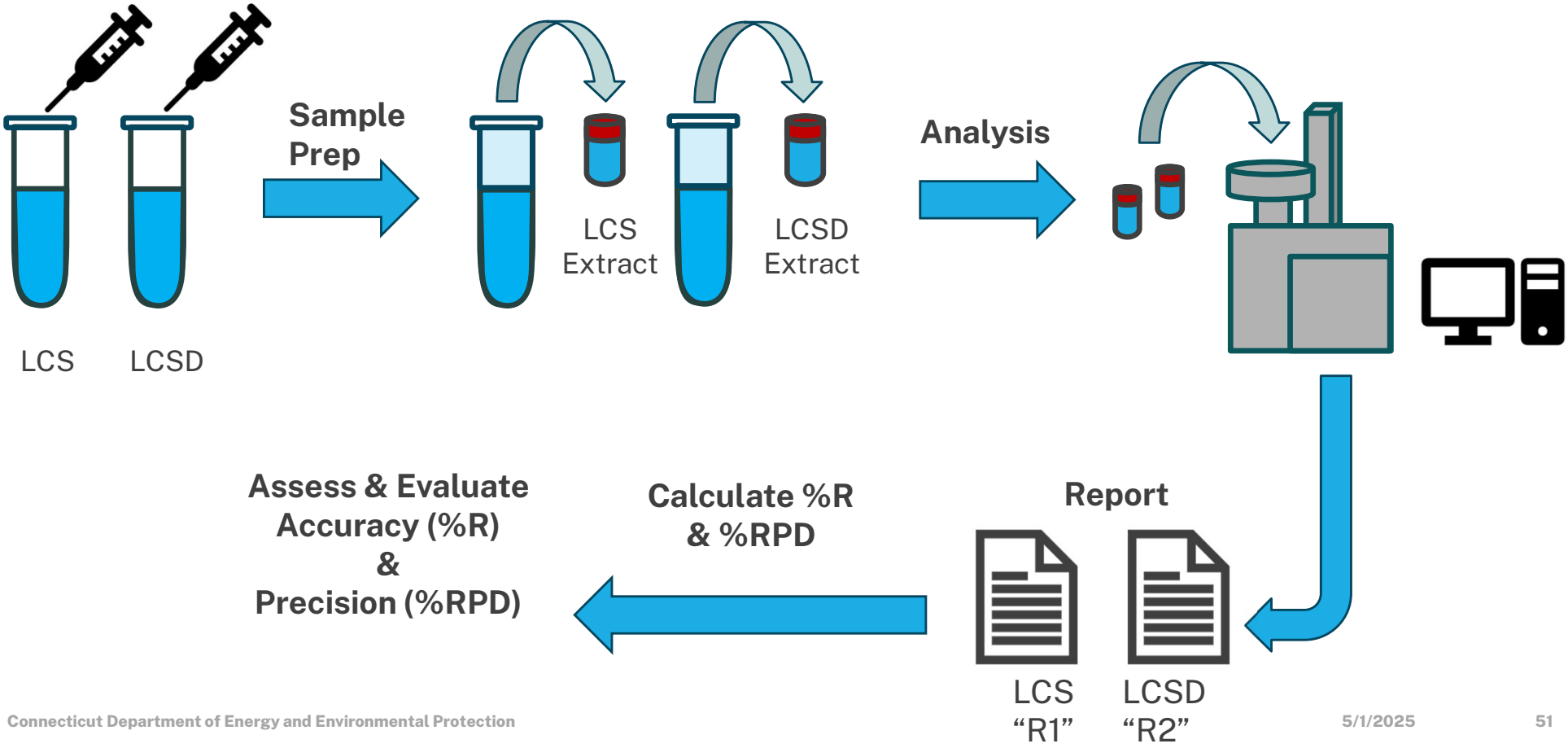
LABORATORY DUPLICATE PREP & ANALYSIS



MS/MSD PREP & ANALYSIS



LCS/LCSD PREP & ANALYSIS
AQUEOUS SAMPLES



ACCURACY

A concept used to describe the agreement between an observed value and an accepted reference or true value

CALCULATING ACCURACY – PERCENT RECOVERY

Measures the performance of the analytical method

- Always expect some variability

Used to assess/observe sample matrix interferences

Percent Recovery (%R)

- May indicate high or low bias to data

- **Matrix Spike Recovery calculated using equation:**
  - $\%R = \left(\frac{R_S - R_u}{S}\right) \times 100$
    - R_s = Spiked sample result
    - R_u = Un-spiked sample result
    - S = Spike concentration
- **LCS/ICV/CCV Recovery calculated using equation:**
  - $\%R = \left(\frac{V_m}{V_T}\right) \times 100$
    - V_m = Measured value
    - V_T = True value

Accuracy – Laboratory QC Parameters & Bias

Parameter	Function	Bias Source
ICV/CCV	Demonstrate accuracy of instrument calibration for duration of analysis • Lab-prepped standards with known target analytes	Instrument drift
LCS/LCSD	Demonstrates performance of the overall analytical approach in a matrix free of interferences • Lab-prepped sample with known concentration of analyte(s) of concern • Matrix matched (aqueous or solid) • Prepped with different source standard than calibration	Instrument measurements
Batch MS/MSD	Randomly chosen sample spiked with known concentration of analyte(s) of concern • Measures performance of the analytical method in relation to specific matrix	Matrix interference
Surrogates	Chemically similar analytes spiked into every sample analyzed on instrument • Organics analysis only • Used to evaluate extraction & method performance for each sample • Added to field samples & lab QC samples prior to extraction	Matrix interference for other similar analytes
Internal Standards	Chemically similar analytes spiked into every sample analyzed on instrument • Organics and ICPMS analyses • Monitors instrument drift over the course of the analytical run • Added to field samples & lab QC samples after extraction but prior to analysis	Matrix interference for other similar analytes
RL/LLOQ	Lab prepared standard with lowest concentration of analyte(s) that can be reliably measured.	Instrument performance at low-end of calibration

Accuracy – Field QC Parameters & Bias

Parameter	Function	Bias Source
Site-specific MS/MSD	Assigned sample spiked with known concentration of target analyte(s) • Measures performance of the analytical method in relation to specific matrix for specific sample	Matrix interference
Field/ Trip/ Equipment Blanks	To account for potential contamination during field/sampling/transport procedures • Can affect the accuracy of the concentration reported for a sample	Sampling/handling contamination

Assessing Accuracy-Lab QC Samples*

Scenario	Expected Spike Concentration	Measured Spike Concentration	%Recovery	Example Acceptance Criteria (% range)	Assessment
A	50	28	55	70-130	Low Bias
B	50	74	148	70-130	High Bias

- **How would you assess the results from both scenarios?**
  - **Scenario A**
    - The low recovery indicates a potential low bias for identified target analytes
  - **Scenario B**
    - The high recovery indicates a potential high bias for identified target analytes

*This example is applicable for Lab QC samples including: LCS, Initial Calibration Verification (ICV), Continuing Calibration Verification (CCV), Internal Standards (ISTD), Surrogates (Surr). **Note:** ICV, CCV, and ISTD are not typically included in lab reports

Assessing Accuracy-Matrix Spike

Scenario	Unspiked Sample Concentration	Spiked Sample Concentration	Expected Spike Concentration	%Spike Recovery	Example Acceptance Criteria (% range)	Assessment
A	50	120	50	140	70-130	High Bias
B	50	74	50	48	70-130	Low Bias

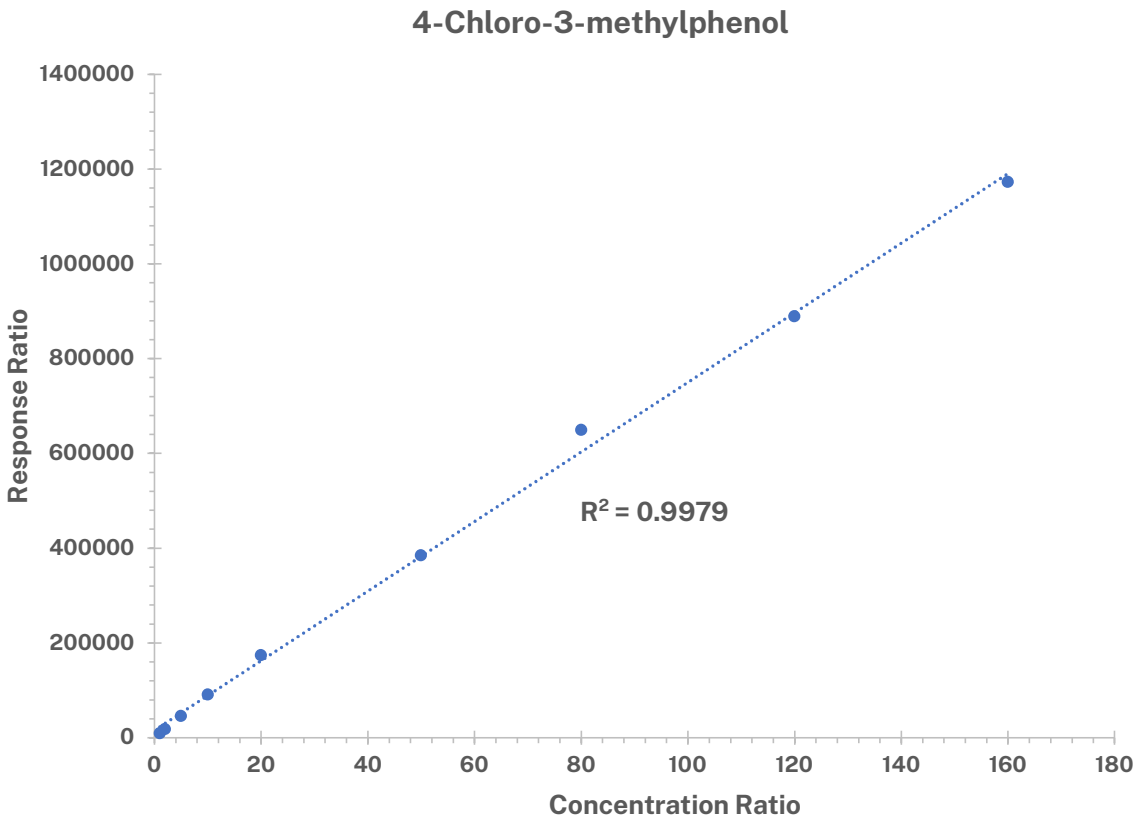
- **How would you assess the results from both scenarios?**
  - **Scenario A**
    - The high recovery indicates a potential high bias for identified target analytes, in the sample matrix.
  - **Scenario B**
    - The low recovery indicates a potential low bias for identified target analytes in the sample matrix.
- **Either Scenario could be an indication of matrix interference depending on other QC indicators like the LCS**

LINEAR RELATIONSHIP & ACCURACY

Calibration curves only have a **linear relationship** (R^2 ≥99.95%) to a **limited** concentration

Once past the calibration range, **relationship** becomes **asymptotic**

- Statistical confidence decreases



LINEAR RELATIONSHIP & ACCURACY

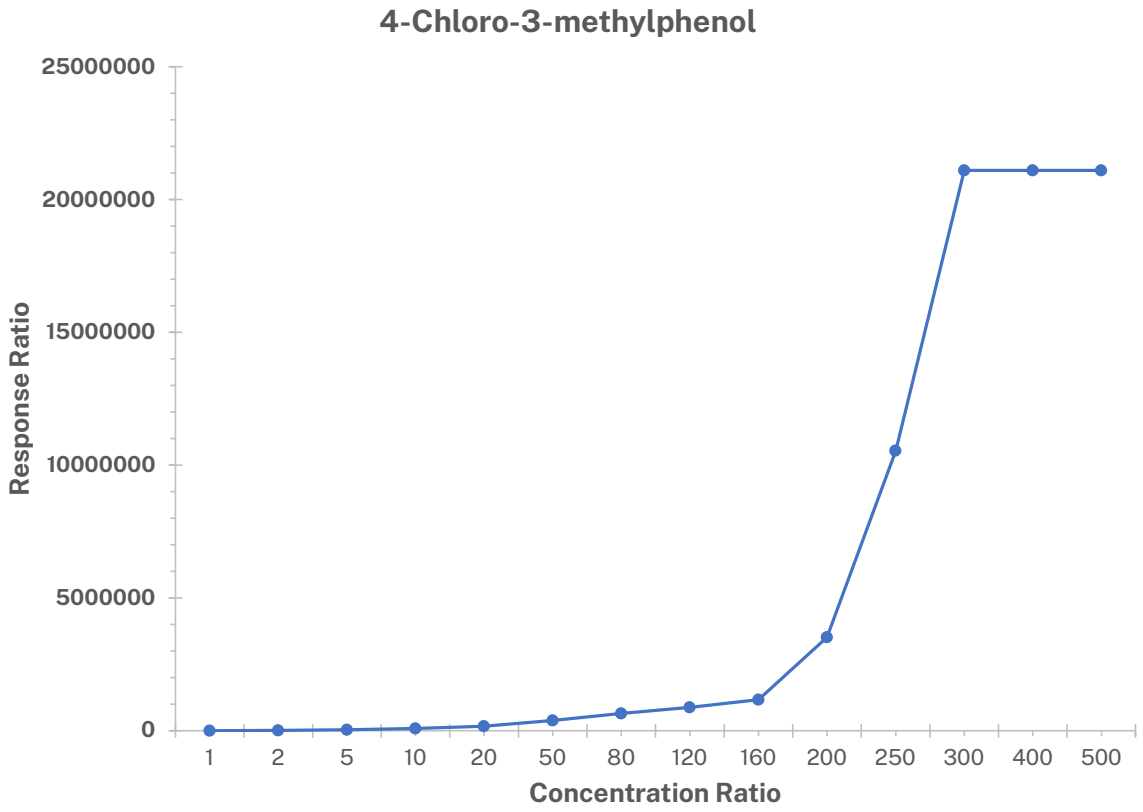
Calibration curves only have a **linear relationship** (R^2 ≥99.95%) to a **limited** concentration

Once past the calibration range, **relationship** becomes **asymptotic**

- Statistical confidence decreases

Sample **concentrations greater** than the established **calibration** range **trigger** the need for a **dilution**

- Measurement not statistically supported
- Sample concentrations outside of the valid calibration should NOT be reported, i.e., no “E” flags



SAMPLE DILUTIONS

Dilutions may be needed for various reasons

- Significantly contaminated samples exceed the instrument calibration range
- Matrix interferences causing poor surrogate/internal standard recovery may be diluted out allowing for better recoveries
- Sample extract may be too viscous for instrument's sample introduction system (i.e., aspirators, injection syringes, etc.) and dilution will lower viscosity for better introduction into instrument

Reporting dilutions

- Dilutions & reason for dilution must be recorded in lab report/narrative
- **RCP UPDATE!** Report lowest dilution within valid calibration range, don't report both undiluted & dilute

SAMPLE DILUTIONS-EXAMPLE

- Industrial site **treats effluent** for hexavalent chromium (Cr^{6+}) to comply with **NPDES permit**
- Method 7196 is colorimetric, i.e., presence of **Cr^{6+}** causes **color change** in the solution prepared by the lab analyst
- Analyst **adds** known concentration of **Cr^{6+}** to MS sample, but there is **no** color change!
- Effluent treatment is causing a **matrix interference**
- Analyst **can't report** accurate MS recovery
- MS **sample is diluted** in attempt to dilute interferant

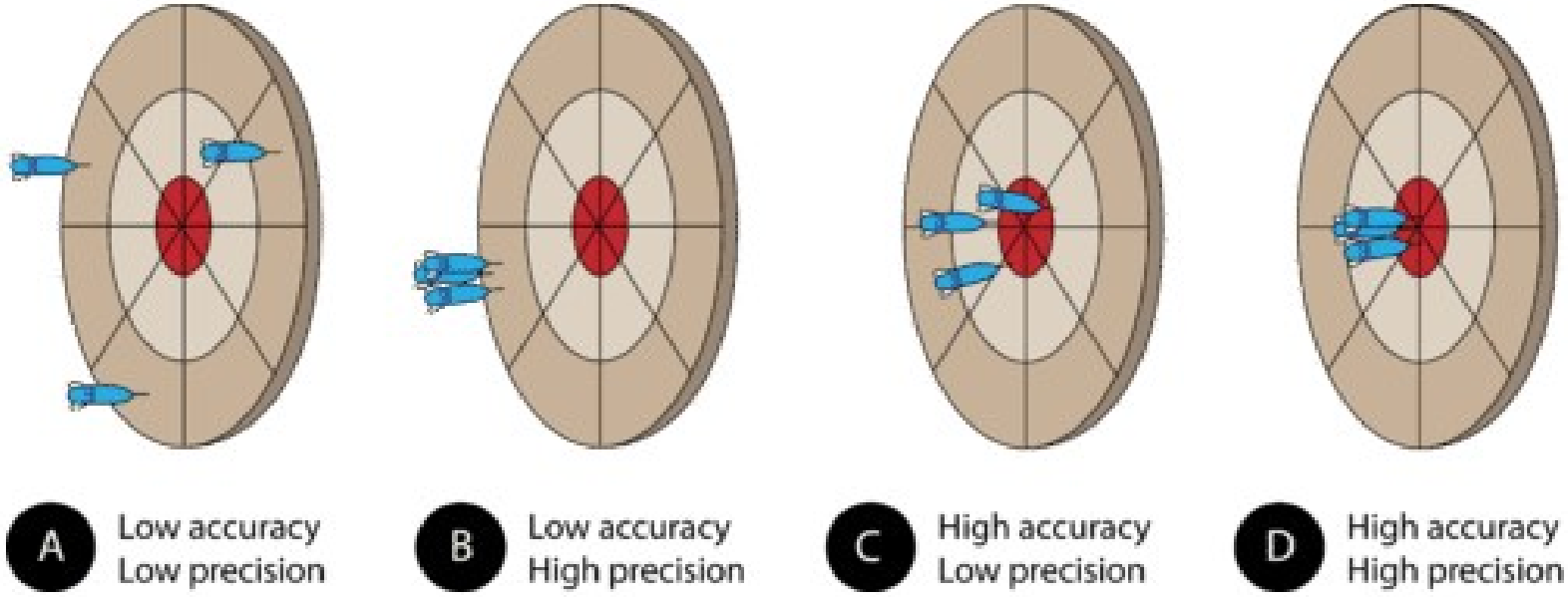
Good news, effluent treatment is working

Bad news, matrix recovery may not meet acceptance criteria

Concept Exercise!

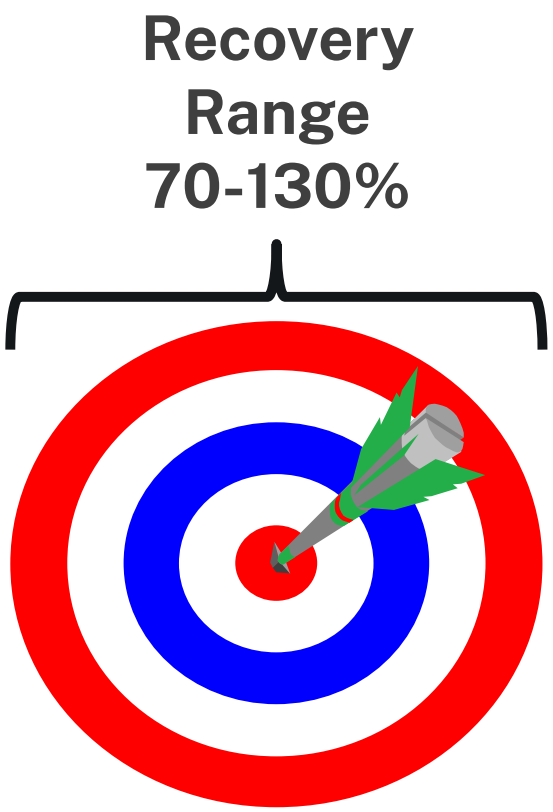
EXERCISE: ACCURACY AND PRECISION

The dartboard analogy



BUT FIRST, THE RULES

- **In this exercise, the target represents the range of the "recovery acceptance criteria"**
- **We'll be practicing assessing "low" and "high" accuracy and precision**
  - The closer an arrow is to the center, the closer to 100% recovery → higher accuracy
  - The farther away from the center (or outside of target) → lower accuracy
  - The tighter the cluster of arrows →more precise
  - The broader the cluster or arrows → less precise
- **We'll navigate through 5 examples**



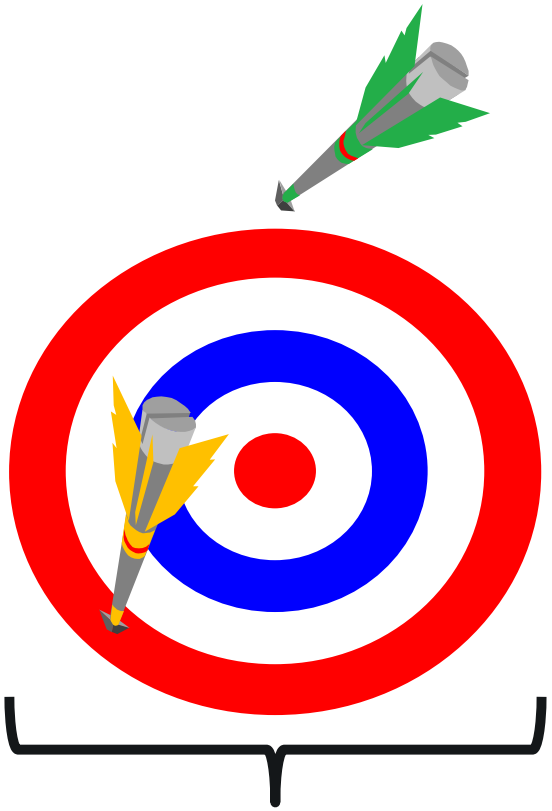
EXAMPLE 1

What type of accuracy is presented here?

Low Accuracy

What type of precision is presented here?

Low Precision



Recovery Range 70-130%

Lab Application:

LCS (R_1) recovers @ 65% → outside of recovery acceptance range

LCSD (R_2) recovers @ 120% → inside of recovery acceptance range

$$\left[\frac{|R_1 - R_2|}{(R_1 + R_2)/2}\right] \times 100 = \%RPD$$

%RPD = 60

RPD acceptance criteria is 30% → precision outside of range

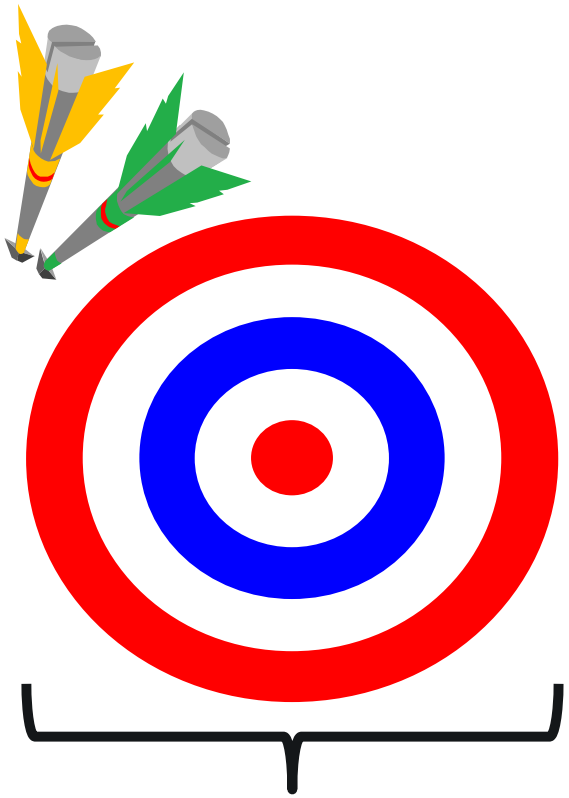
EXAMPLE 2

What type of accuracy is presented here?

Low Accuracy

What type of precision is presented here?

High Precision



Recovery Range 70-130%

Lab Application:

LCS (R_1) recovers @ 65% → outside of recovery acceptance range

LCSD (R_2) recovers @ 55% → outside of recovery acceptance range

$$\left[\frac{|R_1 - R_2|}{(R_1 + R_2)/2}\right] \times 100 = \%RPD$$

%RPD = 17

RPD acceptance criteria is 30% → precision withinrange

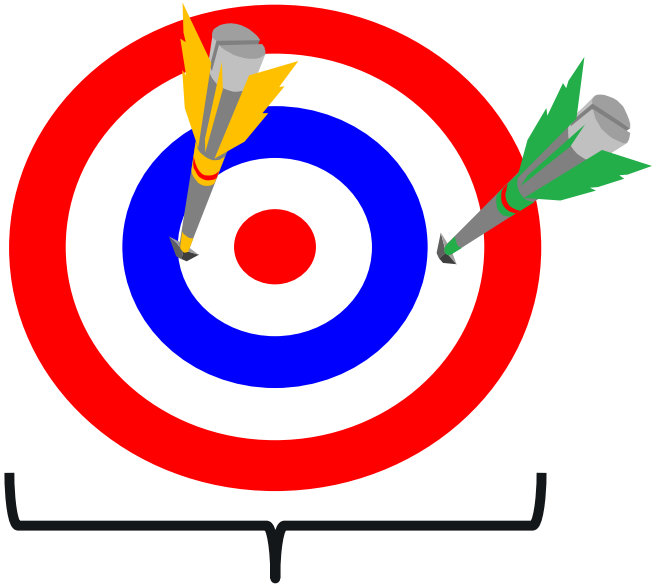
EXAMPLE 3

What type of accuracy is presented here?

High Accuracy

What type of precision is presented here?

Low Precision



Recovery Range 70-130%

Lab Application:

LCS (R_1) recovers @ 75% → inside of recovery acceptance range

LCSD (R_2) recovers @ 120% → inside of recovery acceptance range

$$\left[\frac{|R_1 - R_2|}{(R_1 + R_2)/2}\right] \times 100 = \%RPD$$

%RPD = 46

RPD acceptance criteria is 30% → precision outside of range

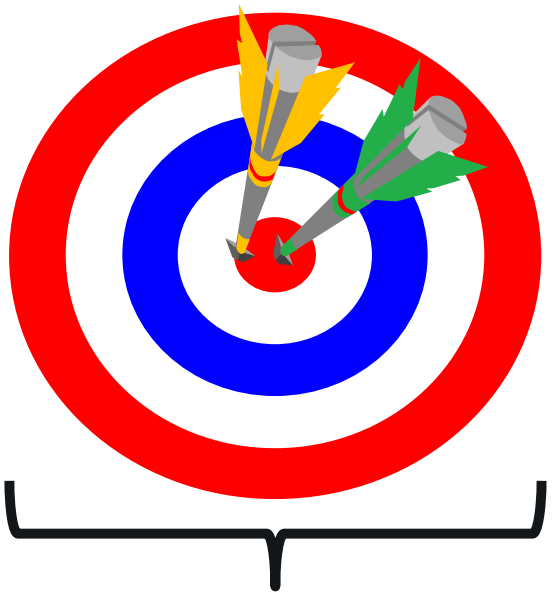
EXAMPLE 4

What type of accuracy is presented here?

High Accuracy

What type of precision is presented here?

High Precision



Recovery Range 70-130%

Lab Application:

LCS (R_1) recovers @ 100% → inside of recovery acceptance range

LCSD (R_2) recovers @ 110% → inside of recovery acceptance range

$$\left[\frac{|R_1 - R_2|}{(R_1 + R_2)/2}\right] \times 100 = \%RPD$$

%RPD = 9.5

RPD acceptance criteria is 30% → precision within range

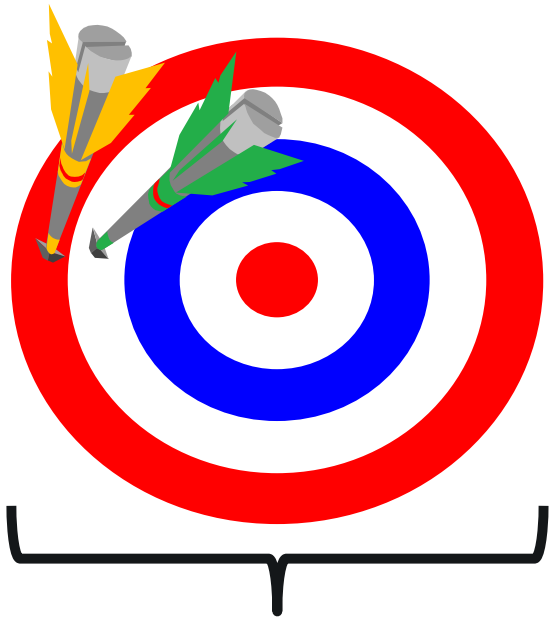
EXAMPLE 5

What type of accuracy is presented here?

High Accuracy

What type of precision is presented here?

High Precision



Recovery Range 70-130%

Lab Application:

LCS (R_1) recovers @ 70% → inside of recovery acceptance range

LCSD (R_2) recovers @ 75% → inside of recovery acceptance range

$$\left[\frac{|R_1 - R_2|}{(R_1 + R_2)/2}\right] \times 100 = \%RPD$$

%RPD = 7

RPD acceptance criteria is 30% → precision within range

EXERCISE DISCUSSION

How does lab precision/accuracy apply to samples?

Lab QC are used to demonstrate precision & accuracy

Provides confidence in the reported sample concentrations

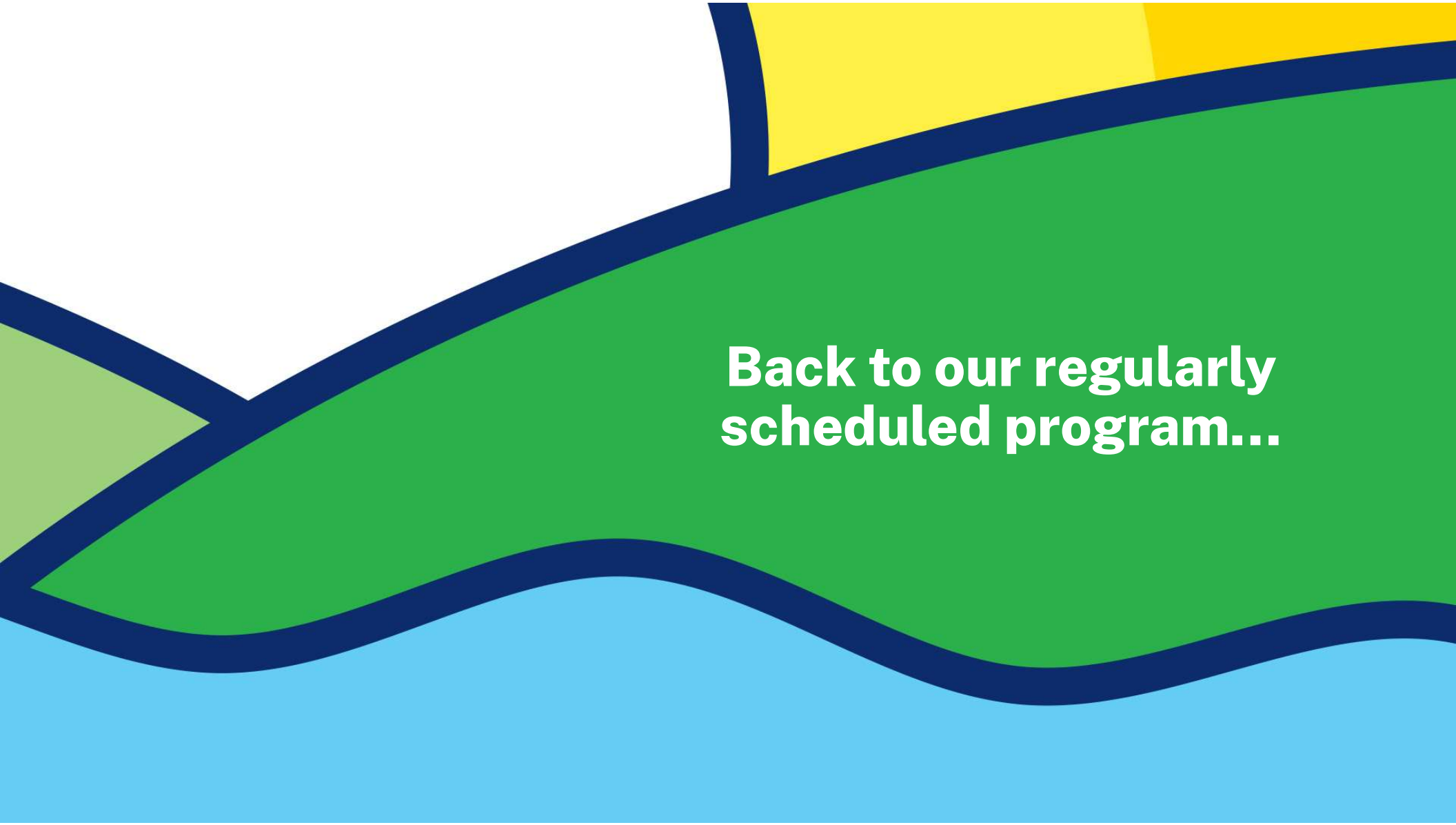
Sample results should not be "corrected"/"normalized" to the recovery results of any of lab QC

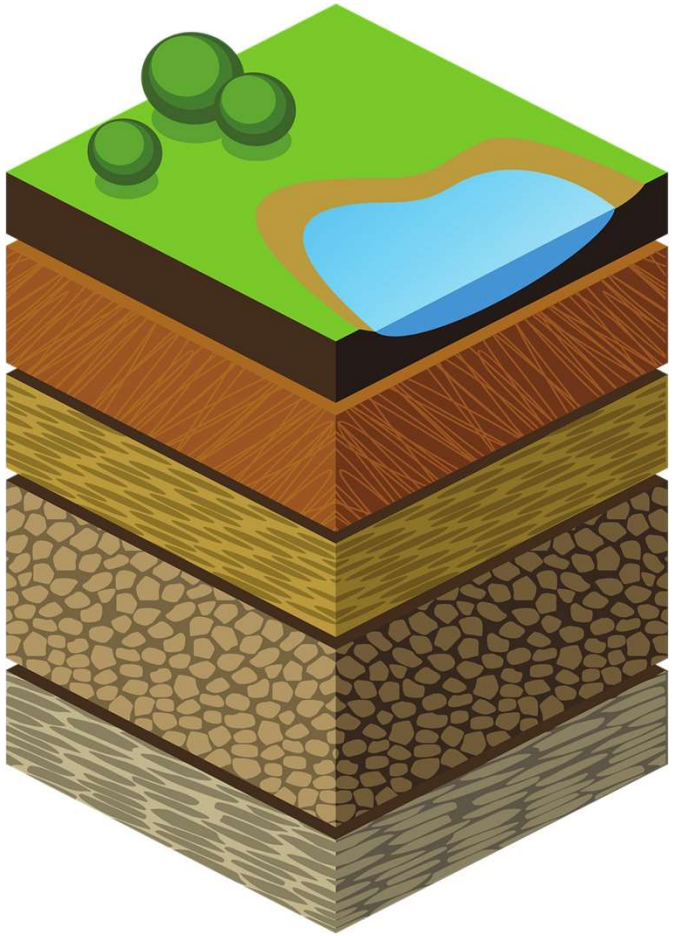
LCS recovers at 80% or 120%, sample results should NOT be adjusted up by 20% or down by 20% because the LCS read lower or higher than 100%

Bias of any lab QC should be used to assess confidence in the sample analysis

Confidence in measurements must support intended use of the data

e.g., Verification, SEH Certification, etc.


Back to our regularly
scheduled program...



REPRESENTATIVENESS

A concept used to describe the degree to which data represent a characteristic of a statistical population or an environmental condition

REPRESENTATIVENESS…

Perhaps the most relevant DQI for environmental studies

An over arching indicator, that pulls things together

Encompasses other DQIs such as precision, accuracy, bias, and completeness

Related to data collection

Examples:

- Soil borings focused in a release area or targeting a defined area of concern.
- Sediment samples in a grid because the area of impact is unknown.
- Groundwater samples characterizing a plume.

COMPARABILITY

A concept used to describe the similarity of attributes of data sets

COMPARABILITY (CONT'D)

Datasets are comparable when they share common sample prep methods, analytical methods and RLs, and laboratory conditions are similar

Primarily qualitative in nature, but there are quantitative indicators

- e.g., RLs, RPDs

Important when evaluating an old dataset against a new dataset to draw inferences about a release

Comparability examples…

- Metals in soils compared to background at site
- ETPH and TPH 418.1 are not comparable

COMPLETENESS

A measure of the amount of usable data obtained, expressed as a percentage of the number of usable measurements that should have been collected

Image source: *EPA Soil and Sediment Results Quick Reference Guide*

COMPLETENESS CONT'D

Should be constantly assessed on qualitative basis in the field

May also be assessed later in the process based on any changes in sample quantity through investigation

Any degree of incompleteness can be problematic

- If missing data biases the results
  - Can bias be explained? How does missing data affect representativeness of the data? Do the data meet project DQOs?
- If missing data are random
  - Do results obtained meet project DQOs and are they adequate for decision-making?

Completeness Examples

Example 1

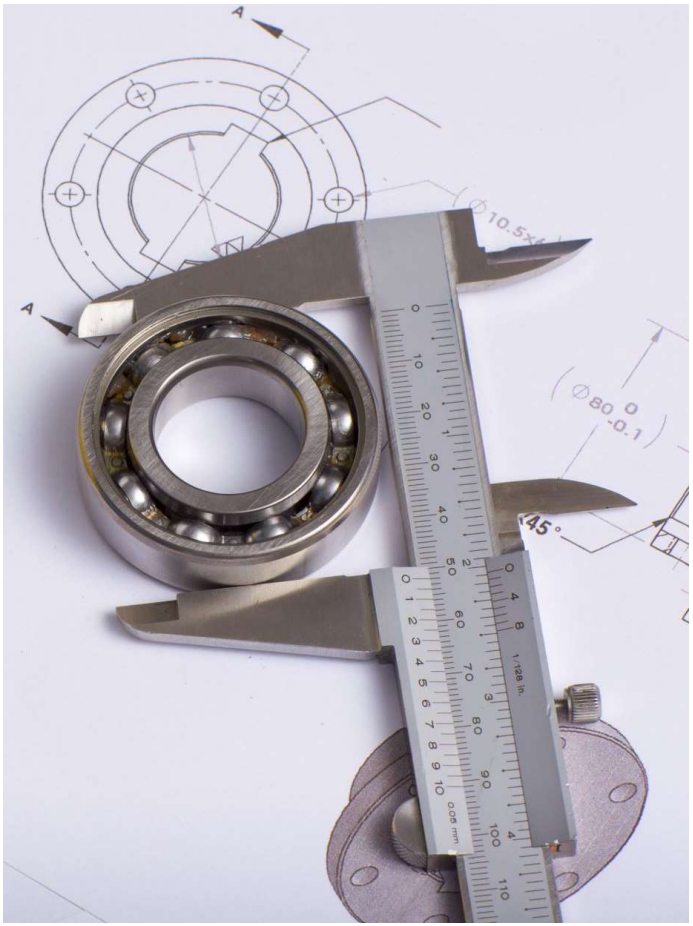
PCB Characterization

- Goal is to collect a sample every 10 ft
- How many data points were usable?
- What if you couldn't collect a sample at every point?
- Is it possible you may not meet completeness goals for Federal regulations?

Example 2

Less Samples Than Planned

- Scope of work states 5 samples were needed to assess a release area
- Only 4 samples could be collected because of an obstruction at the release area
- One of the 4 sample containers broke during transit, so only 3 samples were analyzed
- Completeness may be less than anticipated, need to examine if completeness meets DQOs



SENSITIVITY

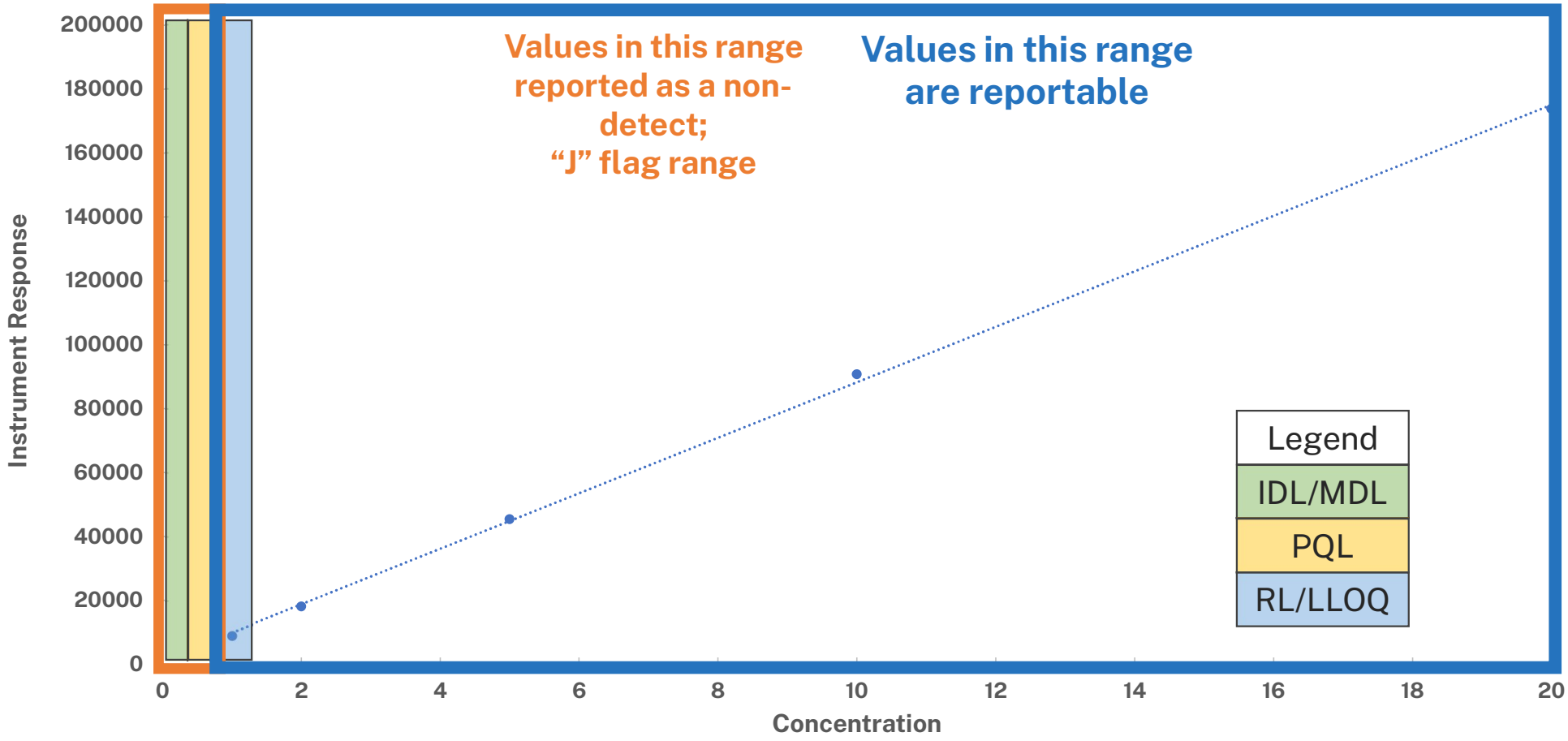
An instrument's, or method's, minimum concentration that can be reliably measured or reported

-EPA Ch. 1, Rev 2, July 2014

Sensitivity Parameters

Acronym	Term	Definition	Notes
IDL	Instrument Detection Limit	Represents the lowest concentration or amount of an analyte that can be reliably distinguished from the background noise or blank signal of an instrument.	Measurement of instrument sensitivity, not accuracy
MDL	Method Detection Limit	Minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero.	Typically, much lower than the RL/PQL/LLOQ
PQL	Practical Quantitation Limit	A statistical approximation of where data accuracy should be reasonable	3-5 times greater than MDL
RL	Reporting Limit	Minimum concentration of a substance that can quantified with acceptable accuracy and precision under routine laboratory conditions.	Typically, several times greater than MDL
LLOQ	Lower Limit of Quantitation	Must be ≥ lowest standard on the calibration curve.	Is dependent upon sample-specific factors such as dilution & sample size

Sensitivity Parameters



INSTRUMENTATION & CALIBRATION

Every instrument needs to be regularly calibrated

- Ranging from field equipment (YSIs, PIDs, etc.) to lab equipment (thermometers, IR guns, etc.) to complex analytical instrument (ICPMS, GC/MS, etc.)

Calibrating informs the analyst that the instrument is functioning properly prior to analysis

Some instruments “hold” their calibration from days to weeks (GC/MS, ICP-MS, LC-MS-MS), while others need daily calibration (YSI, PIDs, etc.)

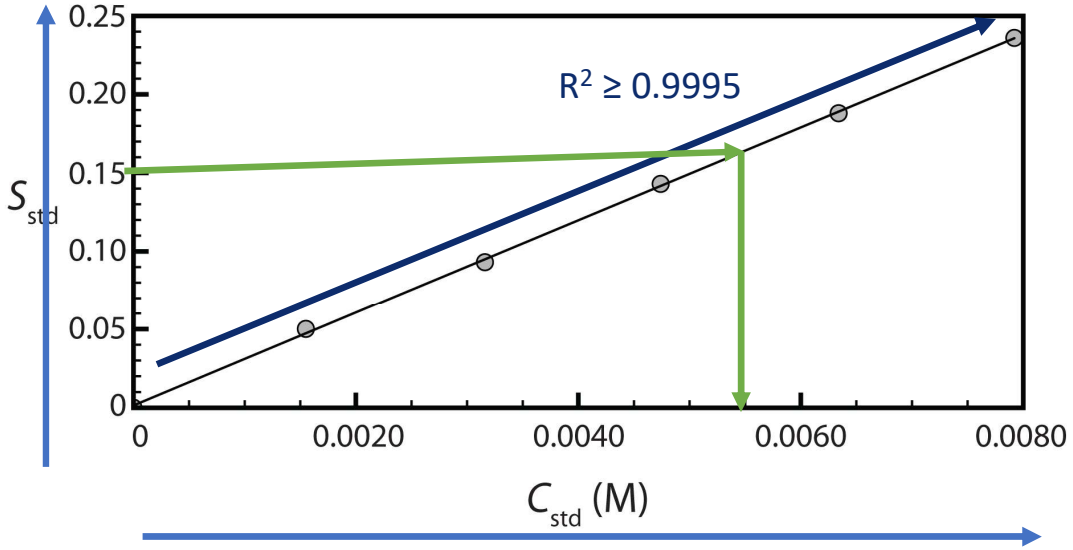
Image published by YSI

NexION 5000 Multi-Quadrupole ICP-MS

Image published by Perkin Elmer

Initial Calibration

- **Use standards with known concentration of target analytes to measure the instrument response**
- **Concentration on x-axis vs instrument response on y-axis**
  - R^2 = correlation coefficient
  - Average Response Factor
- **Analysis should not proceed if R^2 is not ≥99.95%**
  - Indicates a statistical confidence between analyst's ability to prepare samples for analysis and the instrument's response
- **Reported concentration based on instrument response**



CALIBRATION CHECKS

- If some instruments can “hold” a calibration for longer periods of time, how does the lab know the calibration is still “good”?

- By using QC samples to check the calibration!

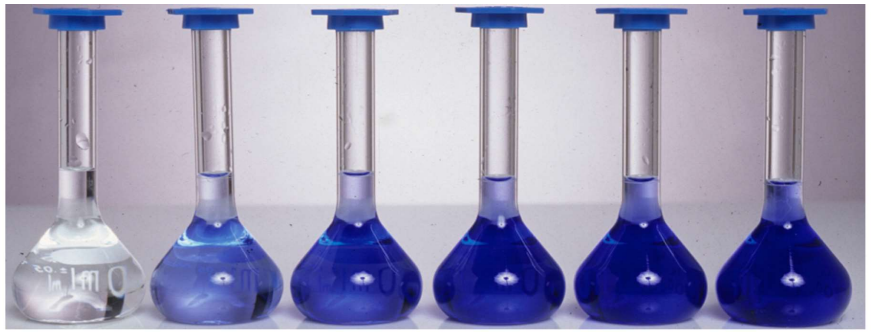
QC Samples
Calibration Verifications

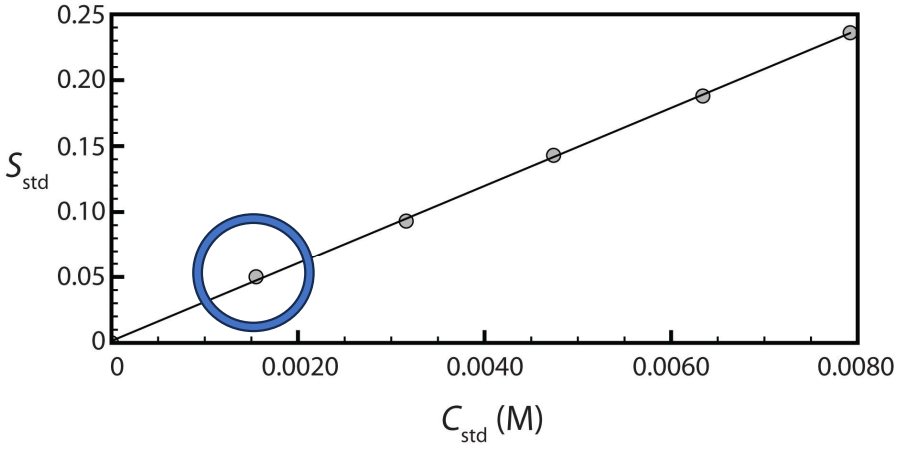
- Calibration curve must be **verified** at **method-defined intervals**
- Initial Calibration Verification (ICV)
  - prepared using a ***different*** **standard source** from calibration standards
- Continuing Calibration Standard (CCV)
  - prepared using ***same*** **standard source** as calibration standards
- ICV & CCV are expected to **perform** within defined **acceptance criteria**
- CCVs that **fail** to meet acceptance criteria indicates a **potential bias** in the reported data
- Lab must **narrate any non-conformances**, if any
- Refer to **Table 1A in RCPs** for further information and corrective actions (if applicable)

QC Samples

Reporting Limits (RL) / Lower Limits of Quantitation (LLOQ)

- **Definition**
  - Concentration of **the lowest non-zero** calibration standard
  - Reportable with >99.95% confidence
- Not specified in methods or RCPs as they **vary lab-to-lab and even day-to-day**
  - Sometimes instruments can have "bad days" too
- RCPs provide **"typical"** RLs/LLOQs based on feedback from lab community
- **Required** report deliverable
- Required for **each analytical run**





Instrument Detection Limit (IDL) & Instrument "Noise"

Often confused with the RL

- RL & IDL are NOT interchangeable

Analyst prepares a standard at the lowest concentration possible for the instrument to "see" with 99%

IDL is calculated on a total of several measurements made throughout the year

- Use a student t-test to calculate final IDL value

Not a report deliverable under RCPs

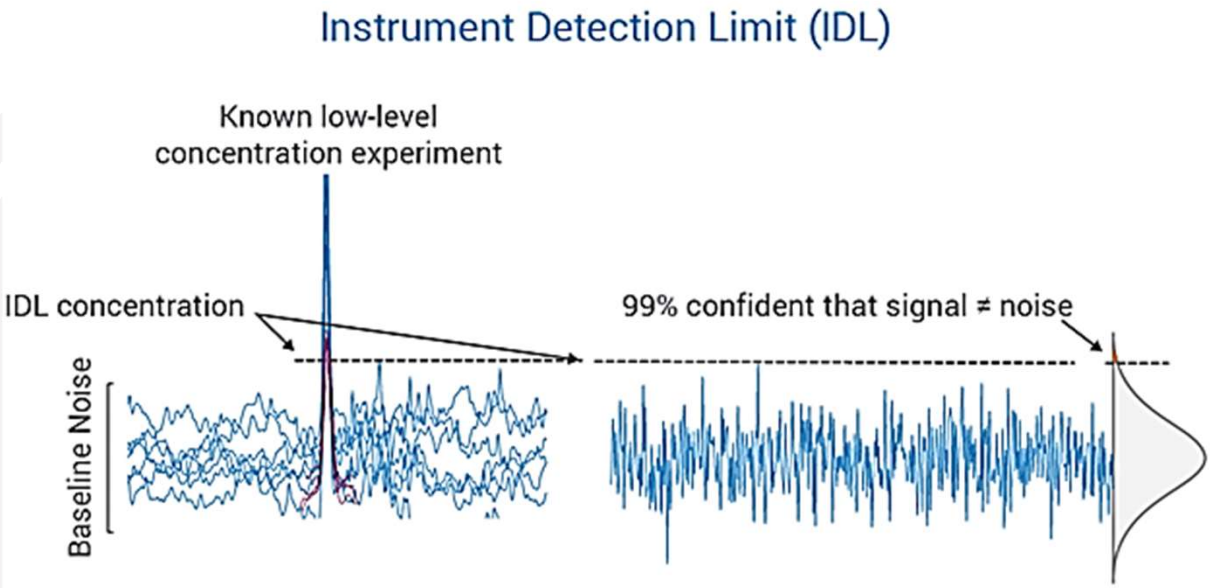


Image published by Agilent Technology: Mass spectrometry sensitivity, instrument detection limit | Agilent

RL vs MDL

Reporting Limit (RL)

Known concentration measured with >99.95% confidence

Analyzed with each batch of field samples

Has defined acceptance criteria

Required report deliverable

Method Detection Limit (MDL)

Statistical value calculated based on multiple measurements of standards throughout the year

Standards are prepared with lowest concentration of analytes possible

Assessed on quarterly basis per EPA Lab Cert (NELAC) requirements

Only reported in audit reports and/or high-level lab reports upon request of data user

QC SAMPLES
BLANKS

Method Blanks

Analyte-free matrix carried through all preparative and analytical procedures in the lab environment

- All analyte concentrations in the Method Blank must be ≤ RL/LLOQ
- Detection of analytes may be indicative of a false positive or lab contamination

Trip/Equipment Blanks

Analyte-free matrix transported to and from site and carried through all lab procedures

- All analyte concentrations in these blanks must be ≤ RL/LLOQ
- Detections of analytes may be indicative of false positive or sample/collection contamination that could be associated in all samples collected at the same time

PARCCS Summary

Quality Assurance

Acronym Soup
What Defines a Quality Assurance Program

Data Quality Indicators

Concept of PARCCS
Purpose of DQIs

PARCCS

Precision
Accuracy
Representativeness
Comparability
Completeness
Sensitivity

QUIZ BREAK

Environmental Analysis & PARCCS

POLL Q2-DATA QUALITY VARIABILITY

- When can Accuracy/Precision variability be first introduced?
  a. At the desk during the planning phase
  b. In the laboratory, as soon as the sample is received
  c. In the field

Q3-Data Quality Indicators

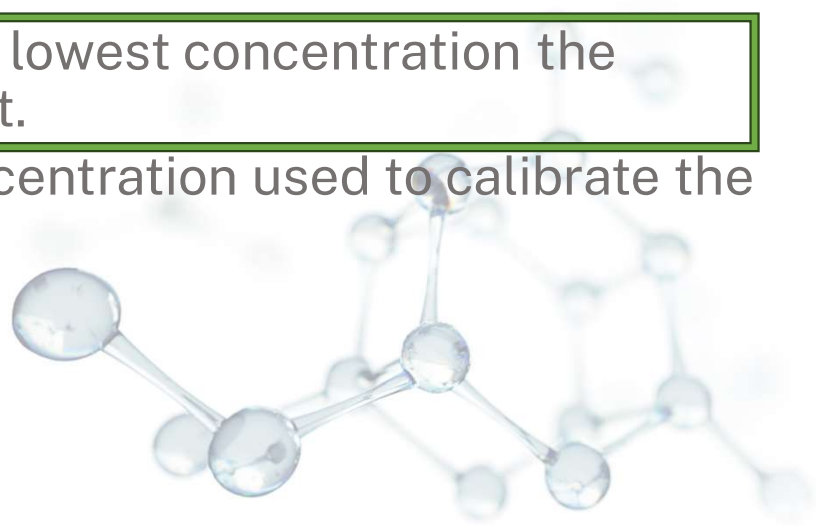
- What's the difference between Data Quality Indicators (DQIs) and Data Quality Objectives (DQOs)?
  a. Nothing, they are the same type of data quality information.
  b. Data Quality Indicators are based on qualitative and quantitative measurements while Data Quality Objectives are data quality goals specific to the investigation.
  c. Data Quality Objectives are specific to laboratory requirements, while Data Quality Indicators are specific acceptance criteria set by the lab.

Q4-Precision & Accuracy

- True or False: It is possible to be both precise and inaccurate
  - True. It is possible to be both precise and inaccurate. You can have an MS/MSD recover low outside of the acceptable range (inaccurate) and have good precision (low RPD).

Q5-MDL vs RL

- How is the Method Detection Limit different than the Report Limit?
  a. It's not, they're the same thing
  b. It is statistically derived at the lowest concentration the instrument can possibly detect.
  c. It is the lowest reportable concentration used to calibrate the instrument.



Q6-Blank Contamination

- LEP Joe submitted a surface water sample for 6020 Metals Analysis
- COC = Arsenic
- Criteria = SWPC
- Reported sample concentration = 12 µg/L (SWPC = 4 µg/L)
- Case Narrative notes the method blank (MB) contains a target analyte at a reported concentration above the RL.
- Reported MB concentration = 1.1 µg/L

Lab ID	Client ID	Method	Compound	QC Outlier	%R or Blank Contaminant	RPD	Bias	Result	Units	SWPC
ABCDE-01	SW-02	SW846 6020	Arsenic	BLK	1.1	-	high	12	ug/L	4.0

Q6-Continued

- Based on the information in RCP 6020 Table 1A, is the reported sample concentration a result of blank contamination?
  a. Yes. Any concentration detected in the blank is indicative of lab contamination.
  b. No. The sample concentration is >10x the concentration in MB, so the MB concentration is negligible.

Method Blank ("MB")	Laboratory Method Sensitivity (contamination evaluation)	(1) One per digestion of ≤ 20 field samples or every batch. (2) Must be digested with the samples using the same preparation method as the samples. (3) Target analytes must be < RL/LLOQ. (4) Matrix specific and matrix matched.	Yes	(1) Reanalyze MB; if acceptable, no further action required. (2) If reanalysis is still outside of criteria, re-digest and reanalyze MB and all associated field samples in (3) If concentration of contamination in MB is > RL/LLOQ but all associated sample results are either non-detected or >10x concentration in MB, no corrective action required.	If (3) applies, include explanation in laboratory report narrative.

RCP 6020 Table 1A *(Ver. May 2024)*

Q7-Sample Labeling

- Looking at this VOC sample, what are potential issues the lab might have during analysis?
  - ☑ a. The septum cap is covered in dirt which can clog up the instrument auto-sampler syringe.
  - ☐ b. The sample labels are covering the vial septum. The lab analyst will have to remove each label before analysis.
  - ☐ c. Tare weight/barcode on vial needs to be visible
  - ☑ d. Dirt could clog cap threads which can affect seal and allow for sample to leak out and/or analytes could volatilize out of vial

QUESTIONS?

Please type your Questions into the Q&A Box

Data Quality Assessment
&
Data Usability Evaluation

Presented by:

Roni Tanguay
DEEP | Remediation Division

Tina Clemmey
ENSAFE

Kevin Vanderveer
DEEP | Remediation Division

Section Outline

Understanding the DQA & DUE Processes

Data Quality Assessment (DQA) Process

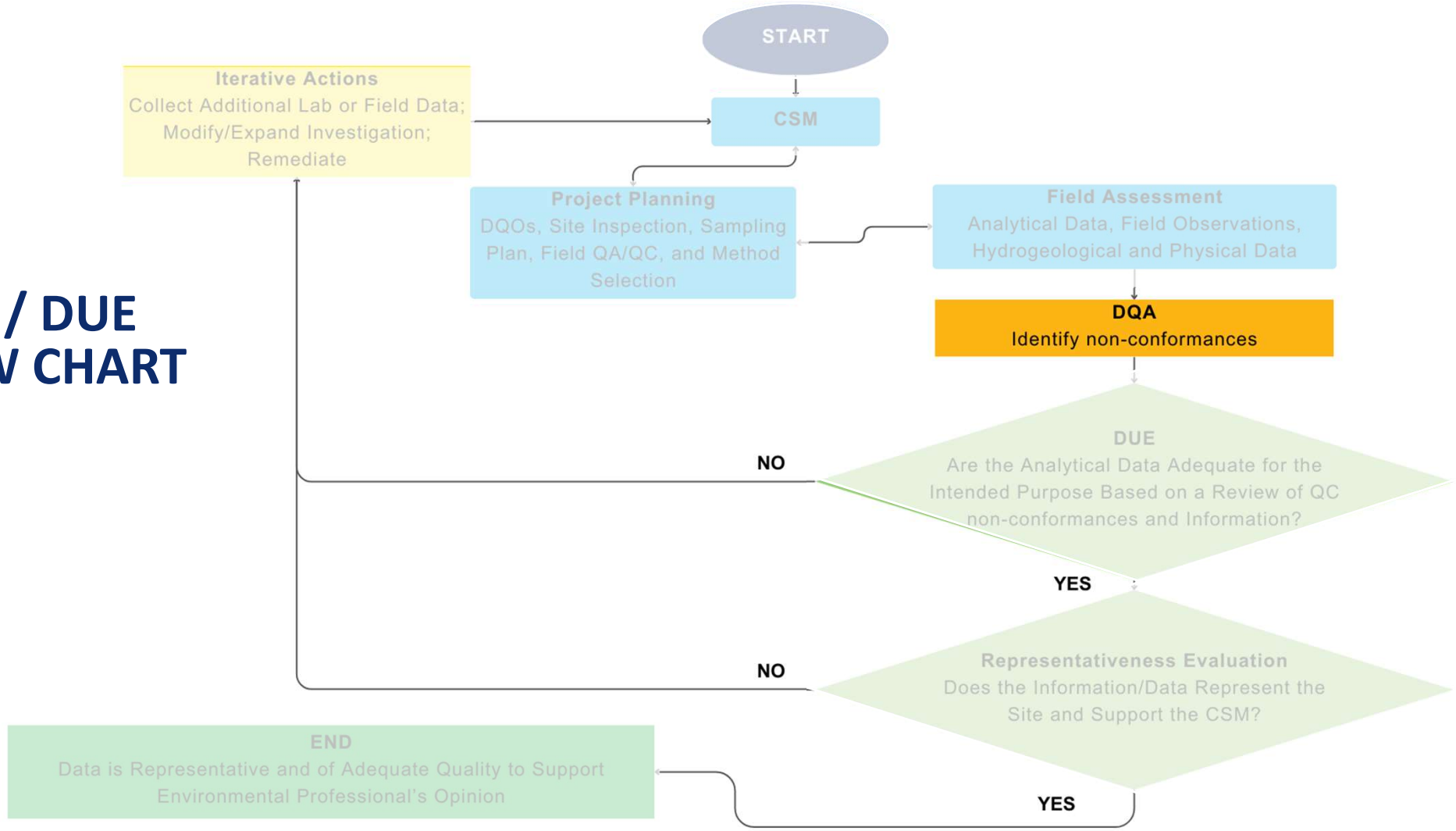
- Reasonable confidence documentation
- Laboratory report & narrative review
- Chain-of-Custody
- DQA documentation

Data Usability Evaluation (DUE) Process

- Evaluating relevancy DQA findings
- Incorporating uncertainty into decision making
- Additional DUE considerations
- Can you justify the use of your data?


DATA QUALITY
ASSESSMENT

DQA / DUE FLOW CHART



The DQA Process

1. Documentation of Reasonable Confidence

- Laboratory Certification Form

2. Reviewing the Lab Reports

- Lab report batch/sample-specific QC summary data section
- Laboratory narrative, narrating non-conformances

3. Reviewing data compared with the Chain-of-Custody

- Check that all samples were analyzed for requested methods
- "You got what you asked for"

4. Document non-conformances in preparation for Data Usability Evaluation

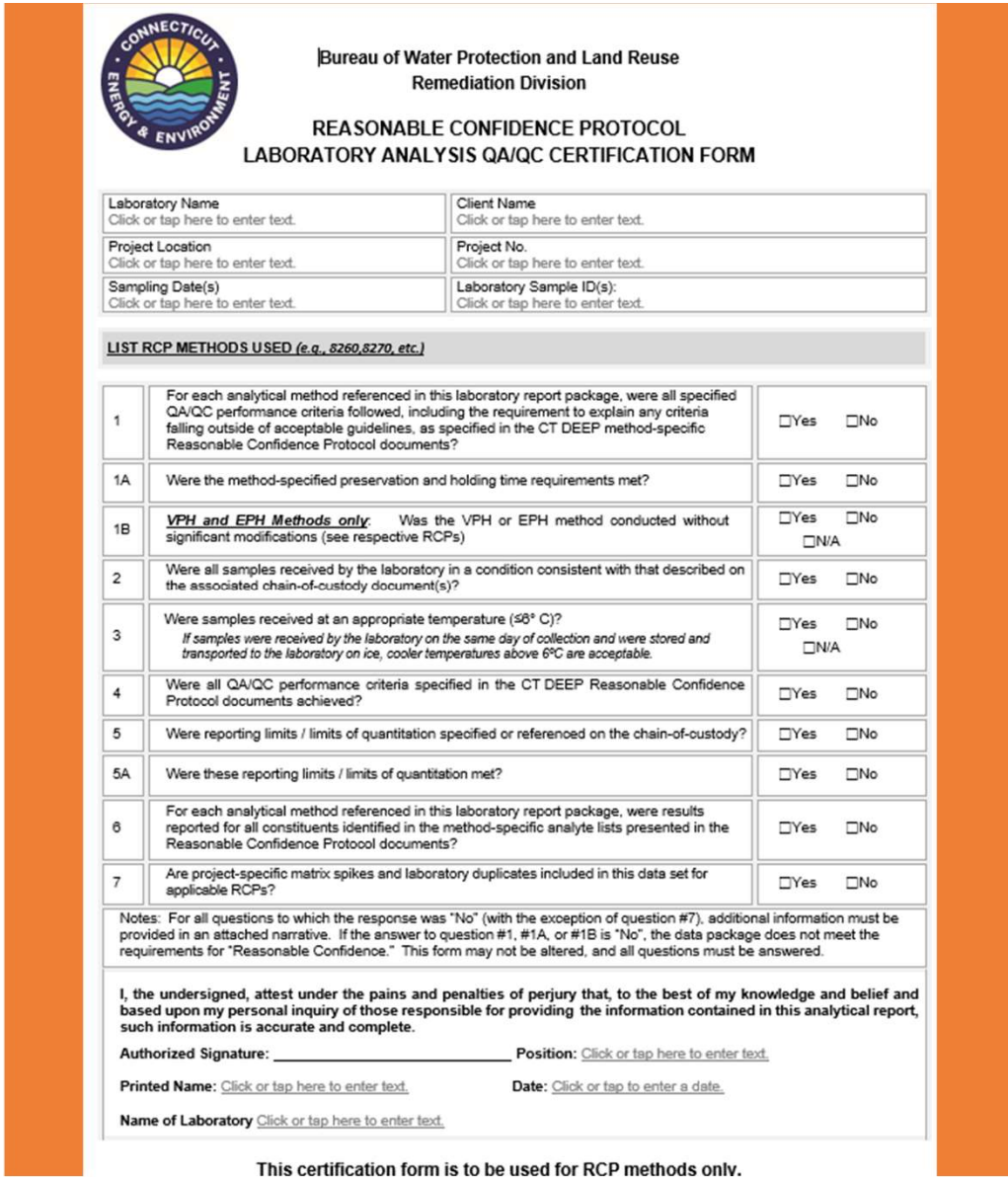
1. Documentation of Reasonable Confidence

Reviewing the RCP Laboratory Certification Form

- Check for "No"s
  - Any "no" requires lab narration
  - EPs should review any non-conformance narrations
- Should be checked as soon as report is received!
  - Don't want to find there was an issue with the sample and/or analysis past holding times which could require re-sampling

RCP Laboratory Certification Form updated in 2024 with updated RCPs!

- Available on DEEP QA/QC webpage



Bureau of Water Protection and Land Reuse
Remediation Division

REASONABLE CONFIDENCE PROTOCOL
LABORATORY ANALYSIS QA/QC CERTIFICATION FORM

Laboratory Name Click or tap here to enter text.	Client Name Click or tap here to enter text.
Project Location Click or tap here to enter text.	Project No. Click or tap here to enter text.
Sampling Date(s) Click or tap here to enter text.	Laboratory Sample ID(s): Click or tap here to enter text.

LIST RCP METHODS USED *(e.g., 8260,8270, etc.)*

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEEP method-specific Reasonable Confidence Protocol documents?	☐Yes ☐No
1A	Were the method-specified preservation and holding time requirements met?	☐Yes ☐No
1B	***VPH and EPH Methods only***: Was the VPH or EPH method conducted without significant modifications (see respective RCPs)	☐Yes ☐No ☐N/A
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	☐Yes ☐No
3	Were samples received at an appropriate temperature (≤6° C)? *If samples were received by the laboratory on the same day of collection and were stored and transported to the laboratory on ice, cooler temperatures above 6°C are acceptable.*	☐Yes ☐No ☐N/A
4	Were all QA/QC performance criteria specified in the CT DEEP Reasonable Confidence Protocol documents achieved?	☐Yes ☐No
5	Were reporting limits / limits of quantitation specified or referenced on the chain-of-custody?	☐Yes ☐No
5A	Were these reporting limits / limits of quantitation met?	☐Yes ☐No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the Reasonable Confidence Protocol documents?	☐Yes ☐No
7	Are project-specific matrix spikes and laboratory duplicates included in this data set for applicable RCPs?	☐Yes ☐No

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Reasonable Confidence." This form may not be altered, and all questions must be answered.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete.

Authorized Signature: _____ **Position:** Click or tap here to enter text.

Printed Name: Click or tap here to enter text. **Date:** Click or tap to enter a date.

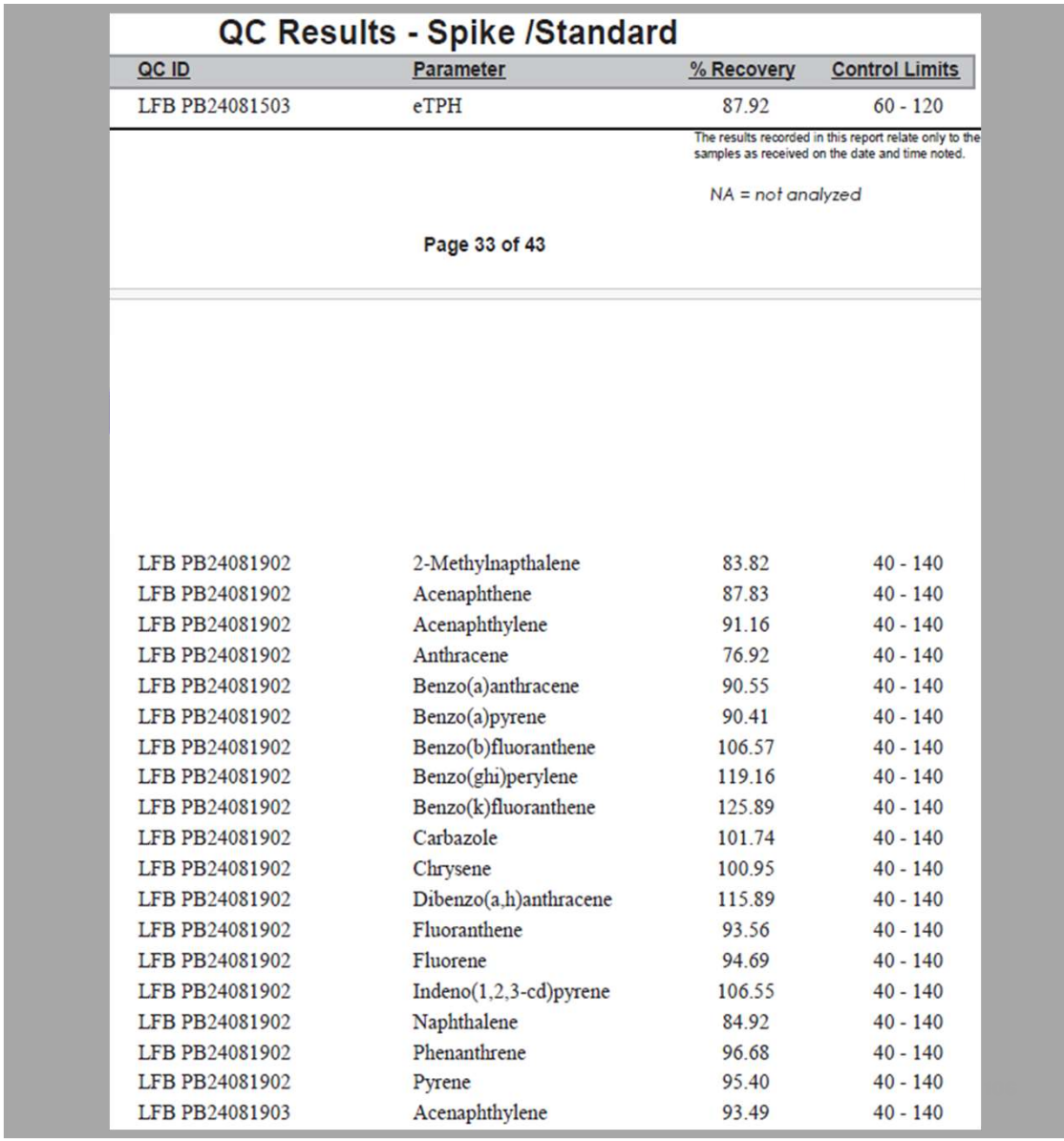
Name of Laboratory Click or tap here to enter text.

This certification form is to be used for RCP methods only.

2. Reviewing the Laboratory Report

Lab report batch/sample-specific QC summary data section

- Recall PARCCS DQIs
  - **Precision:** lab and field duplicates, MS/MSD pairs
  - **Accuracy:** MS, surrogates, internal standards, LCS
  - **Sensitivity:** blanks, methods, matrix issues, DQOs



QC Results - Spike /Standard

QC ID	Parameter	% Recovery	Control Limits
LFB PB24081503	eTPH	87.92	60 - 120

The results recorded in this report relate only to the samples as received on the date and time noted.

NA = not analyzed

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LFB PB24081902	2-Methylnapthalene	83.82	40 - 140
LFB PB24081902	Acenaphthene	87.83	40 - 140
LFB PB24081902	Acenaphthylene	91.16	40 - 140
LFB PB24081902	Anthracene	76.92	40 - 140
LFB PB24081902	Benzo(a)anthracene	90.55	40 - 140
LFB PB24081902	Benzo(a)pyrene	90.41	40 - 140
LFB PB24081902	Benzo(b)fluoranthene	106.57	40 - 140
LFB PB24081902	Benzo(ghi)perylene	119.16	40 - 140
LFB PB24081902	Benzo(k)fluoranthene	125.89	40 - 140
LFB PB24081902	Carbazole	101.74	40 - 140
LFB PB24081902	Chrysene	100.95	40 - 140
LFB PB24081902	Dibenzo(a,h)anthracene	115.89	40 - 140
LFB PB24081902	Fluoranthene	93.56	40 - 140
LFB PB24081902	Fluorene	94.69	40 - 140
LFB PB24081902	Indeno(1,2,3-cd)pyrene	106.55	40 - 140
LFB PB24081902	Naphthalene	84.92	40 - 140
LFB PB24081902	Phenanthrene	96.68	40 - 140
LFB PB24081902	Pyrene	95.40	40 - 140
LFB PB24081903	Acenaphthylene	93.49	40 - 140

2. Reviewing the Laboratory Report Cont'd

Laboratory Narrative

Lab narrative includes all notes of issues of significance to data user related to*

- Method performance problems
- QA/QC outliers
- Hold time exceedances
- Matrix interferences
- Reporting limits
- Physical sample characteristics

*List of non-conformance examples provided is not all inclusive, there can be many others included in any lab report

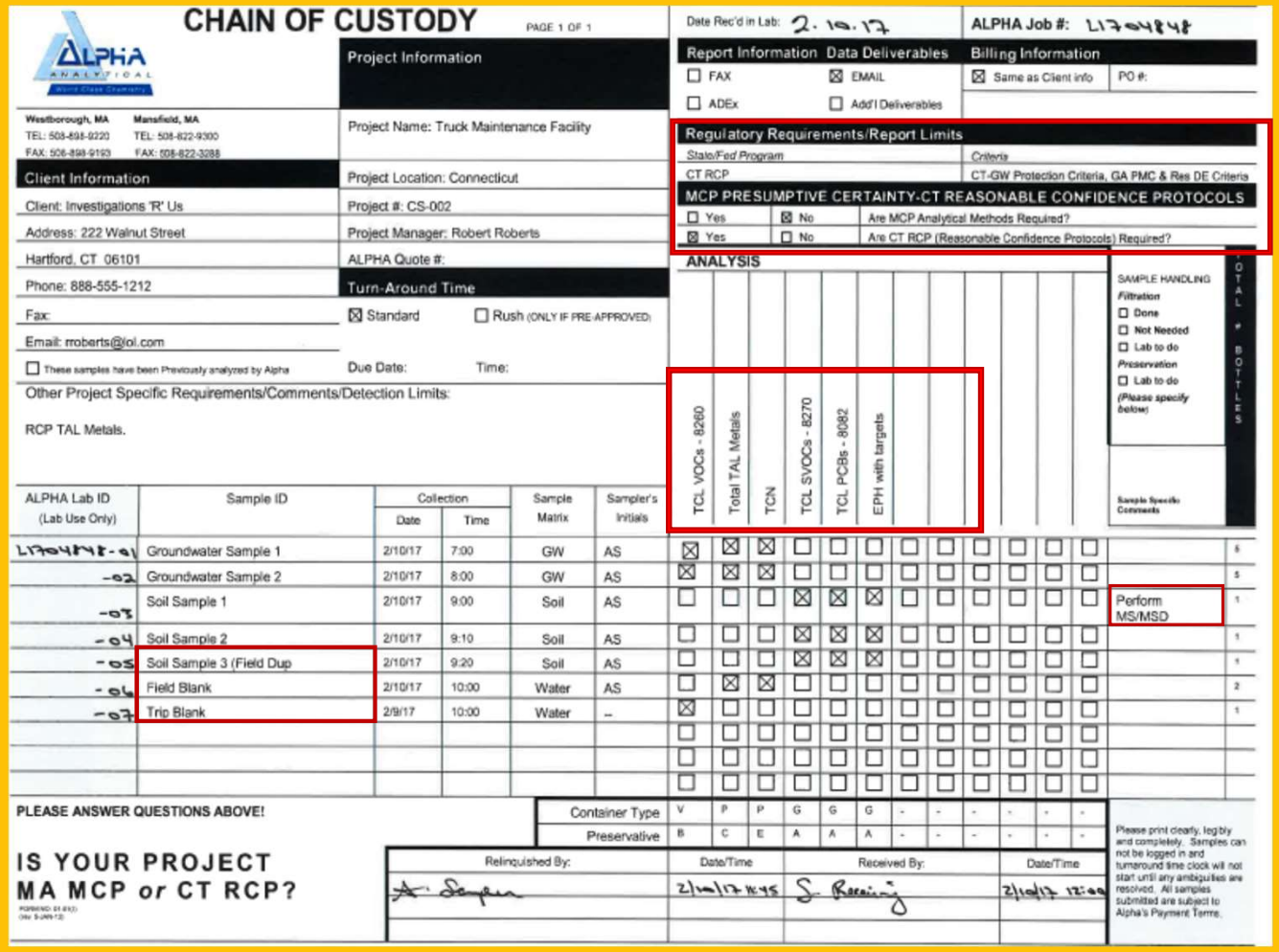
Case Narrative

Batch/Sample ID QC Type	Parameter	Method	Result	Limits
QC2408319	Phenanthrene	SW-846 8270E	0.2814	0.2
Blank	Blank result is outside limits, positive sample results associated with this batch are qualified, as possible lab contamination.			
QC2408324	Chrysene	SW-846 8270E	121.2	80 - 120
Cal1	Result is above limits, sample results associated with this batch are bias high.			
QC2408324	Fluoranthene	SW-846 8270E	120.8	80 - 120
Cal1	Result is above limits, sample results associated with this batch are bias high.			
QC2408324	Fluorene	SW-846 8270E	121.4	80 - 120
Cal1	Result is above limits, sample results associated with this batch are bias high.			
QC2408390	1,4-Dioxane	SW-846 8260D	126.9	80 - 120
Cal1	Result is above limits, sample results associated with this batch are bias high.			
QC2408390	Tetrachloroethylene	SW-846 8260D	120.4	80 - 120
Cal1	Result is above limits, sample results associated with this batch are bias high.			
QC2408390	trans-1,4-Dichloro-2-butene	SW-846 8260D	77.85	80 - 120
Cal1	Result is below limits, sample results associated with this batch are bias low.			
QC2408390 LCSD	Tetrachloroethylene	SW-846 8260D	69.67	70 - 130
LCSD	Result is below limits, samples results associated with this batch are bias low.			

All Samples were received on Ice and in accordance with their Chain of Custody. Temperatures were within acceptable limits. Question 6 on the RCP Certification form is answered "No", because the chain of custody requested a reduced list of metals and semi-volatiles compared to the RCP list .

3. Reviewing the Chain-of-Custody

- Check that the lab completed all requested analyses marked on the chain-of-custody submitted with samples
- Check regulatory criteria matches between form & lab report
- Check that sample/batch-specific QC were analyzed, if requested
- Essentially, ***make sure "You got what you paid for"***



CHAIN OF CUSTODY PAGE 1 OF 1

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193
Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Client Information
Client: Investigations 'R' Us
Address: 222 Walnut Street
Hartford, CT 06101
Phone: 888-555-1212
Fax:
Email: rroberts@iol.com
☐ These samples have been Previously analyzed by Alpha

Project Information
Project Name: Truck Maintenance Facility
Project Location: Connecticut
Project #: CS-002
Project Manager: Robert Roberts
ALPHA Quote #:

Turn-Around Time
☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)
Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:
RCP TAL Metals.

Date Rec'd in Lab: 2.10.17
ALPHA Job #: L1704848

Report Information: ☐ FAX ☐ ADEx
Data Deliverables: ☒ EMAIL ☐ Add'l Deliverables
Billing Information: ☒ Same as Client info PO #:

Regulatory Requirements/Report Limits
Stato/Fed Program: CT RCP
Criteria: CT-GW Protection Criteria, GA PMC & Res DE Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS
☐ Yes ☒ No Are MCP Analytical Methods Required?
☒ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

ANALYSIS

SAMPLE HANDLING
Filtration: ☐ Done ☐ Not Needed ☐ Lab to do
Preservation: ☐ Lab to do
(Please specify below)

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	TCL VOCs - 8260	Total TAL Metals	TCN	TCL SVOCs - 8270	TCL PCBs - 8082	EPH with targets	Sample Specific Comments	Total # Bottles
L1704848-01	Groundwater Sample 1	2/10/17	7:00	GW	AS	☒	☒	☒	☐	☐	☐		5
-02	Groundwater Sample 2	2/10/17	8:00	GW	AS	☒	☒	☒	☐	☐	☐		5
-03	Soil Sample 1	2/10/17	9:00	Soil	AS	☐	☐	☐	☒	☒	☒	Perform MS/MSD	1
-04	Soil Sample 2	2/10/17	9:10	Soil	AS	☐	☐	☐	☒	☒	☒		1
-05	Soil Sample 3 (Field Dup	2/10/17	9:20	Soil	AS	☐	☐	☐	☒	☒	☒		1
-06	Field Blank	2/10/17	10:00	Water	AS	☐	☒	☒	☐	☐	☐		2
-07	Trip Blank	2/9/17	10:00	Water	--	☒	☐	☐	☐	☐	☐		1
						☐	☐	☐	☐	☐	☐		
						☐	☐	☐	☐	☐	☐		
						☐	☐	☐	☐	☐	☐		

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Container Type	V	P	P	G	G	G	-	-	-	-	-	-
Preservative	B	C	E	A	A	A	-	-	-	-	-	-

Relinquished By:	Date/Time	Received By:	Date/Time
A. Sampler	2/10/17 11:45	S. Receiving	2/10/17 12:00

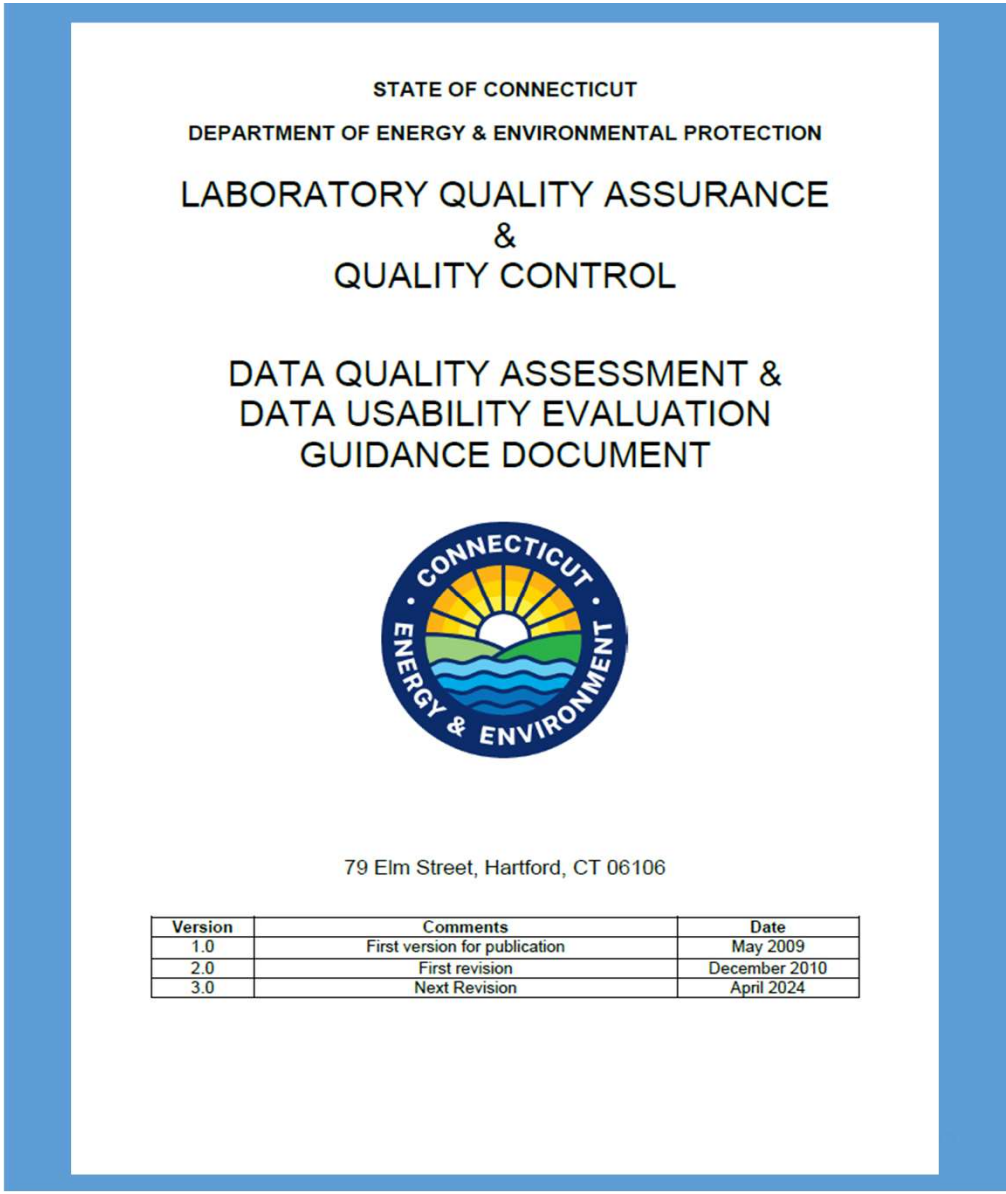
Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

4. Document Non-Conformances

Summarize DQA findings

- Were the RCPs achieved per the RCP Certification Form?
  - If non-RCP analytical methods used, was equivalency documented & demonstrated for DEEP review?
- Were there any non-conformances?
  - Document or summarize non-conformances narrated by laboratory using documentation tools such as:
    - ❑ Tables summarizing non-conformances
    - ❑ Paper/electronic copies of non-conformances
    - ❑ Worksheets available in DEEP DQA/DUE Guidance Document
- Were all analyses and associated QC completed per the submitted chain-of-custody?

Refer to DEEP DQA/DUE Guidance Document for more resources & appendices



STATE OF CONNECTICUT

DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION

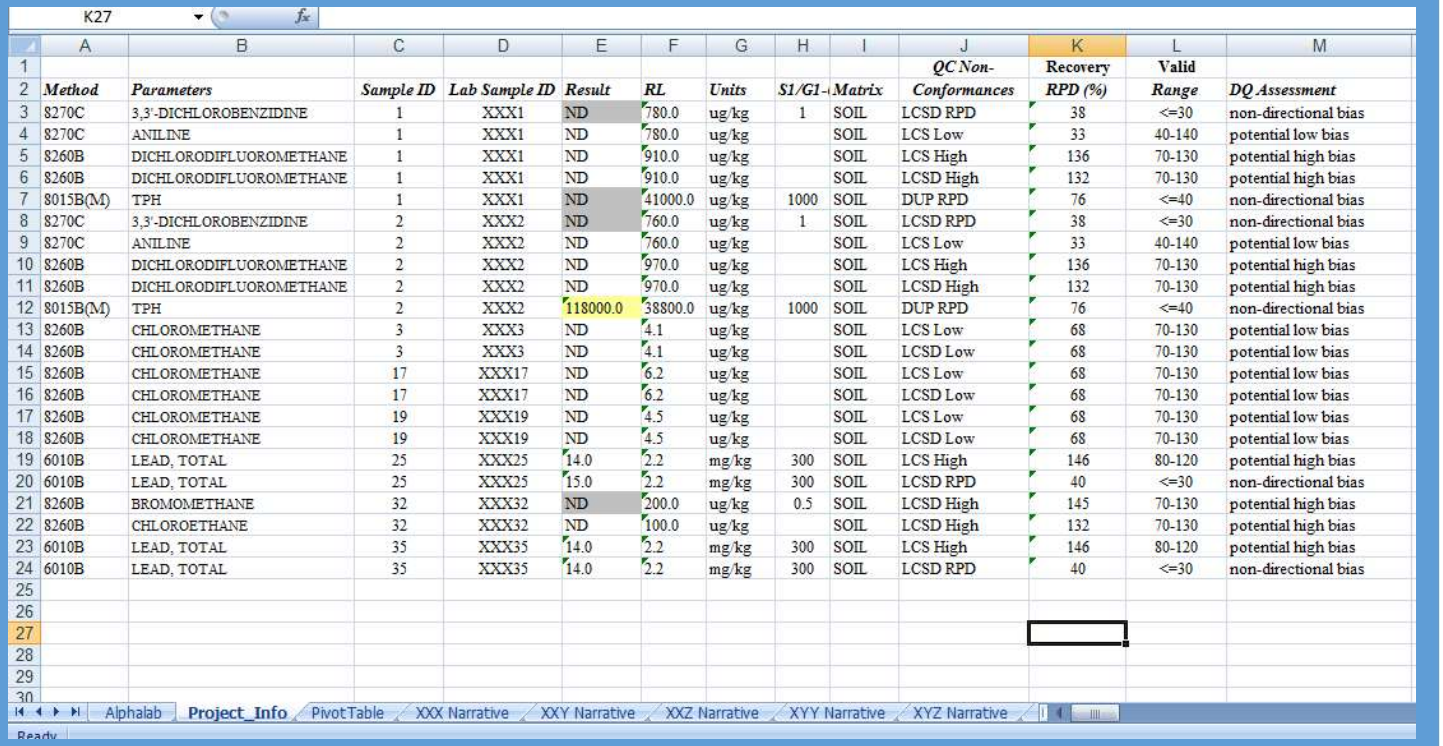
LABORATORY QUALITY ASSURANCE
&
QUALITY CONTROL

DATA QUALITY ASSESSMENT &
DATA USABILITY EVALUATION
GUIDANCE DOCUMENT

79 Elm Street, Hartford, CT 06106

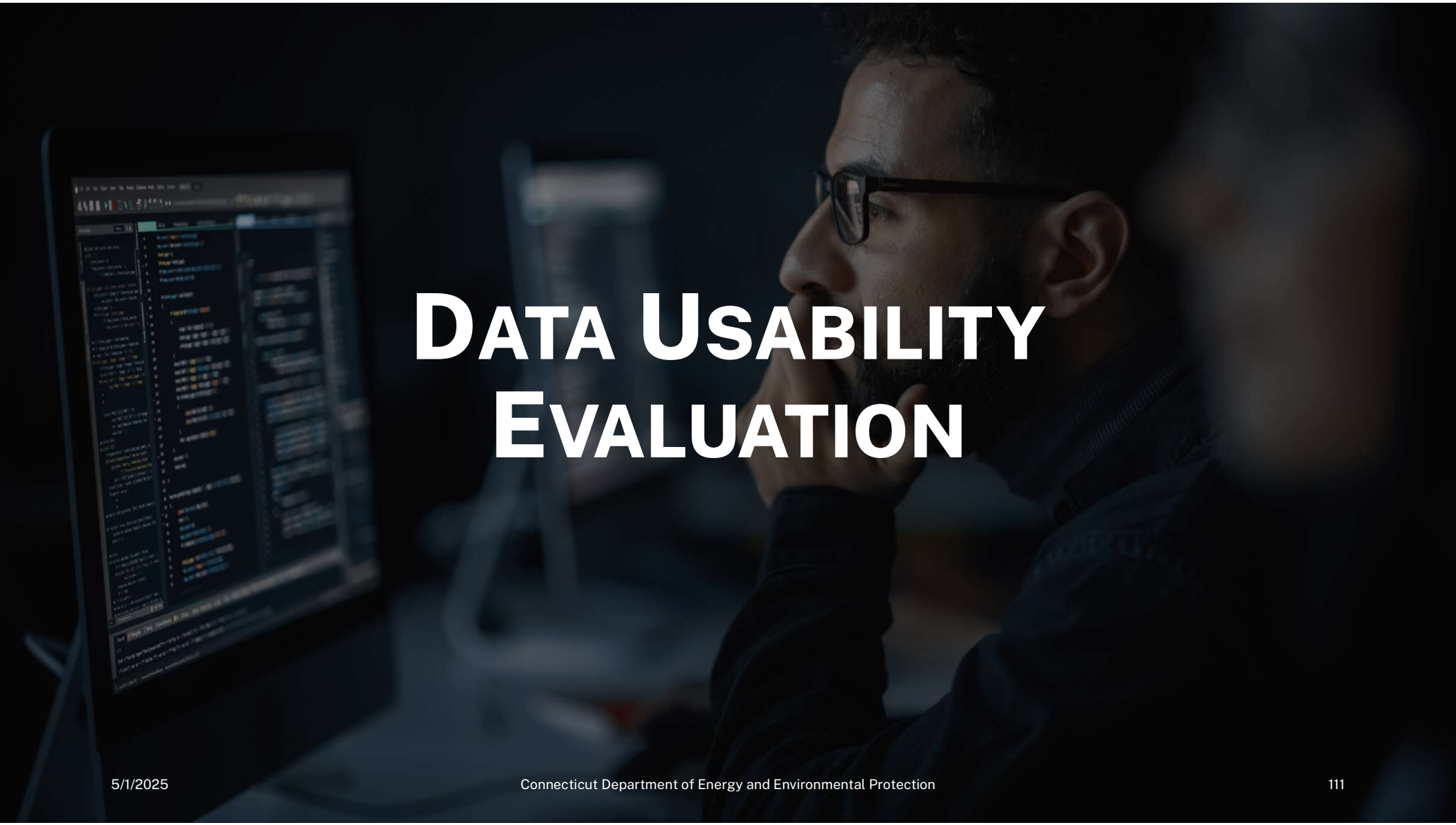
Version	Comments	Date
1.0	First version for publication	May 2009
2.0	First revision	December 2010
3.0	Next Revision	April 2024

4. DOCUMENTATION EXAMPLE

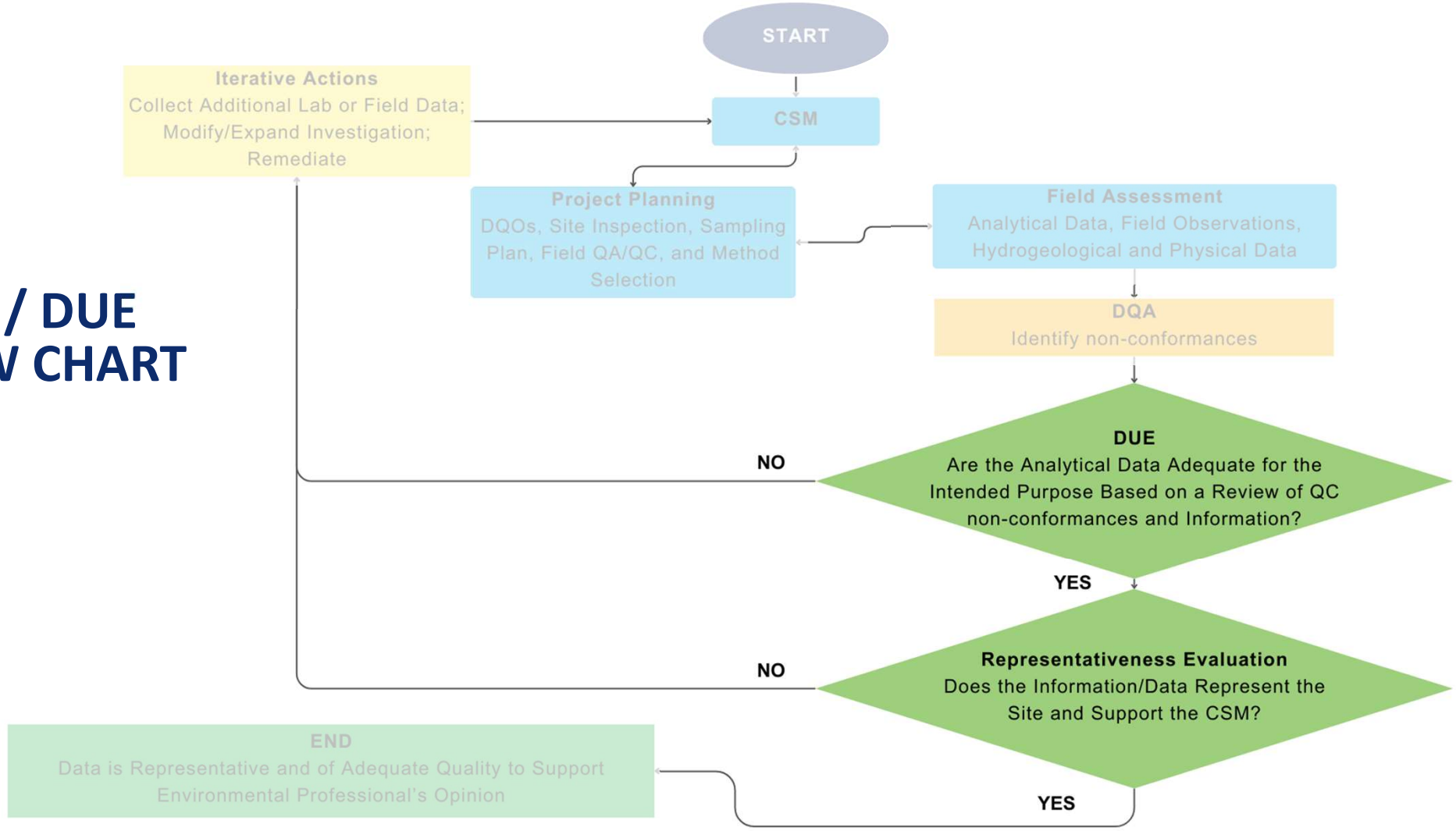


Method	Parameters	Sample ID	Lab Sample ID	Result	RL	Units	S1/G1-(	Matrix	QC Non-Conformances	Recovery RPD (%)	Valid Range	DQ Assessment
8270C	3,3'-DICHLOROBENZIDINE	1	XXX1	ND	780.0	ug/kg	1	SOIL	LCSD RPD	38	<=30	non-directional bias
8270C	ANILINE	1	XXX1	ND	780.0	ug/kg		SOIL	LCS Low	33	40-140	potential low bias
8260B	DICHLORODIFLUOROMETHANE	1	XXX1	ND	910.0	ug/kg		SOIL	LCS High	136	70-130	potential high bias
8260B	DICHLORODIFLUOROMETHANE	1	XXX1	ND	910.0	ug/kg		SOIL	LCSD High	132	70-130	potential high bias
8015B(M)	TPH	1	XXX1	ND	41000.0	ug/kg	1000	SOIL	DUP RPD	76	<=40	non-directional bias
8270C	3,3'-DICHLOROBENZIDINE	2	XXX2	ND	760.0	ug/kg	1	SOIL	LCSD RPD	38	<=30	non-directional bias
8270C	ANILINE	2	XXX2	ND	760.0	ug/kg		SOIL	LCS Low	33	40-140	potential low bias
8260B	DICHLORODIFLUOROMETHANE	2	XXX2	ND	970.0	ug/kg		SOIL	LCS High	136	70-130	potential high bias
8260B	DICHLORODIFLUOROMETHANE	2	XXX2	ND	970.0	ug/kg		SOIL	LCSD High	132	70-130	potential high bias
8015B(M)	TPH	2	XXX2	118000.0	38800.0	ug/kg	1000	SOIL	DUP RPD	76	<=40	non-directional bias
8260B	CHLOROMETHANE	3	XXX3	ND	4.1	ug/kg		SOIL	LCS Low	68	70-130	potential low bias
8260B	CHLOROMETHANE	3	XXX3	ND	4.1	ug/kg		SOIL	LCSD Low	68	70-130	potential low bias
8260B	CHLOROMETHANE	17	XXX17	ND	6.2	ug/kg		SOIL	LCS Low	68	70-130	potential low bias
8260B	CHLOROMETHANE	17	XXX17	ND	6.2	ug/kg		SOIL	LCSD Low	68	70-130	potential low bias
8260B	CHLOROMETHANE	19	XXX19	ND	4.5	ug/kg		SOIL	LCS Low	68	70-130	potential low bias
8260B	CHLOROMETHANE	19	XXX19	ND	4.5	ug/kg		SOIL	LCSD Low	68	70-130	potential low bias
6010B	LEAD, TOTAL	25	XXX25	14.0	2.2	mg/kg	300	SOIL	LCS High	146	80-120	potential high bias
6010B	LEAD, TOTAL	25	XXX25	15.0	2.2	mg/kg	300	SOIL	LCSD RPD	40	<=30	non-directional bias
8260B	BROMOMETHANE	32	XXX32	ND	200.0	ug/kg	0.5	SOIL	LCSD High	145	70-130	potential high bias
8260B	CHLOROETHANE	32	XXX32	ND	100.0	ug/kg		SOIL	LCSD High	132	70-130	potential high bias
6010B	LEAD, TOTAL	35	XXX35	14.0	2.2	mg/kg	300	SOIL	LCS High	146	80-120	potential high bias
6010B	LEAD, TOTAL	35	XXX35	14.0	2.2	mg/kg	300	SOIL	LCSD RPD	40	<=30	non-directional bias

- ✓ Methods with reported non-conformance(s)
- ✓ Target analyte(s) associated with non-conformance(s)
- ✓ Reported result
- ✓ Reported RL
- ✓ QC Non-conformance
- ✓ %R or %RPD
- ✓ Acceptance Criteria
- ✓ Assessed bias


DATA USABILITY
EVALUATION

DQA / DUE FLOW CHART



The DUE Process

Evaluating relevancy of data & non-conformances

- Contaminants of Concern
- Sample Location(s)
- Significance of data point(s)
- Data bias
- Relationship to clean-up goals and regulatory standards

Incorporating uncertainty into decision making

- Evaluating significance of non-conformance effects on data usability
- Multiple lines of evidence

Additional DUE considerations

- Representativeness
- Comparability
- Completeness

Intended Use of Data

- Does the data meet the DQOs for the project?

Evaluating Relevancy of Data & Non-Conformances

Contaminants of Concern

- Reported COCs agree with site history & CSM

Sample location

- Reported data for sample location consistent throughout history of data collection
- Or is reported data different than usual?

Significance

- How does this data point affect the investigation/CSM?
- Does data indicate further investigation required?

Data Bias

- Low bias – potential for under reporting concentrations
- High bias – potential for over reporting concentrations → more conservative!
- Indeterminate bias – discrepancies between QA samples, i.e., duplicates (RPD) and calibration (ICV, CCV)

BIAS IN RELATION TO CLEAN-UP CRITERIA

- EPs should NOT correct reported concentrations based on spike recoveries
- EPs need to consider sample concentrations in relation to regulatory criteria & any reported bias

***Spike %R acceptance criteria is 70-130%**

Sample Result	Spike %R*	RSR Criteria	Bias	What does this bias mean?
50	22%	55	Low	Sample result is close to criteria and potentially under-reported. EP should assess if re-sampling is necessary to achieve the objective.
50	135%	1	High	Sample result is significantly greater than criteria and potentially over-reported. Data is likely usable to confirm an exceedance of criteria.
50	135%	45	High	Sample result is close to criteria and potentially over-reported. Data is likely usable to confirm an exceedance of criteria.

Incorporating Uncertainty into Decision Making

Significance of Non-Conformances

Recorded non-conformances do not necessarily mean data isn't usable

- Need to consider how non-conformances relate to PARCCS DQIs

Severity of non-conformance

- Difference between 9% R and 135% R
  - Low recovery could be indicative of matrix issues, under-reported concentrations, etc.
    - Compare concentration in spiked sample against concentrations reported in original, un-spiked sample
  - High recoveries could be indicative of over-reporting & matrix issues
    - More conservative approach

Importance of the data point(s)

- Does non-conformance affect Completeness/Representativeness of the dataset in relation to the CSM?
- What are reported concentrations in relation to criteria?

Use of the data point(s)

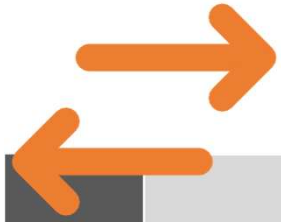
- Are they being used to identify a release occurred?
- Are they being used to demonstrate compliance?

Incorporating Uncertainty into Decision Making

Multiple Lines of Evidence - Bias

Additive

- **Consistent bias narrated in QC samples**
- **Batch Example:**
  - CCV and LCS are biased low for the same compounds
- **Sample Example:**
  - CCV and MS/MSD are biased low for the same compounds



Contradictory

- **Low and high bias narrated in QC samples**
- **Batch Example:**
  - CCV is biased high, but the LCS is biased low for the same compounds
- **Sample Example:**
  - CCV is biased high, but the MS/MSD are biased low

Incorporating Uncertainty into Decision Making

Multiple Lines of Evidence – LCS/LCSD & MS/MSD Results

LCS/LCSD

Batch-specific, representative of a clean matrix

Used to demonstrate lab performance of analytical approach in matrix free of interferences & analytical system is in control

- Non-conformance is indicative of method “performance”

Should be used in conjunction with MS/MSD results to separate issues of laboratory performance and "matrix effects.”

If LCS/LCSD passes but the MS/MSD fails

- This indicates the potential for sample-specific matrix interference
- Indicates the method was performed appropriately by the lab

RCPs require a successful LCS to report data

MS/MSD

Sample-specific, representative of sample matrix

Used to assess the accuracy and precision of a testing method for a specific sample

- Non-conformance is indicative of interference present in the sample matrix

Results may indicate if reported concentration of target analyte(s) is truly what is present in sample(s)

Should be used in conjunction with LCS/LCSD

For EP interpretation, lab does NOT interpret usability of MS/MSD data

Incorporating Uncertainty into Decision Making

Multiple Lines of Evidence – Matrix Interferences

What are Matrix Interferences?

All environmental samples have complex matrices

Samples can include co-analytes that elute (organics) or absorb similar wavelengths (metals) as the target analytes

These interferences can cause low or high recovery (bias) in a sample

RL Effects

Dilution, co-elution, absorption effects

Can increase final RL

Remember! RLs shouldn't be > criteria

Example: VOC samples that have surfactants present can cause foaming issues during the injection process

Spike Recovery Effects

MS/MSD, Surrogates, Internal Standards can all be biased by interferences

Concentrations > Cal Curve

Some samples can have base concentrations that are already elevated

Adding a matrix spike increases concentration above calibration curve which will require a dilution

INCORPORATING UNCERTAINTY INTO DECISION MAKING

SURROGATE SPIKE RECOVERY

Surrogate*	% Recovery	Qualifier	Acceptance Criteria
Nitrobenzene-d5	70		30-130
2-fluorobiphenyl	110		30-130
Terphenyl-d14	**150**		30-130

*In this example, these surrogates are associated with “base-neutral” SVOC compounds

- Surrogate recoveries **typically** at end of each sample report after target analyte results
- Composed of analytes of **similar class** to those being analyzed, **NOT** the same analytes used in the calibration process
- Recoveries may indicate a **QC issue** exists for **more than one** compound, rather than any specific compound, unlike MS/MSDs, which do
- Example, if **Terphenyl-d14** recovers high that may indicate all **base-neutral compounds** biased **high**
- It may be necessary for the data user to discuss potential data usability limitations with the lab

Additional DUE Considerations

Consider information beyond current lab report

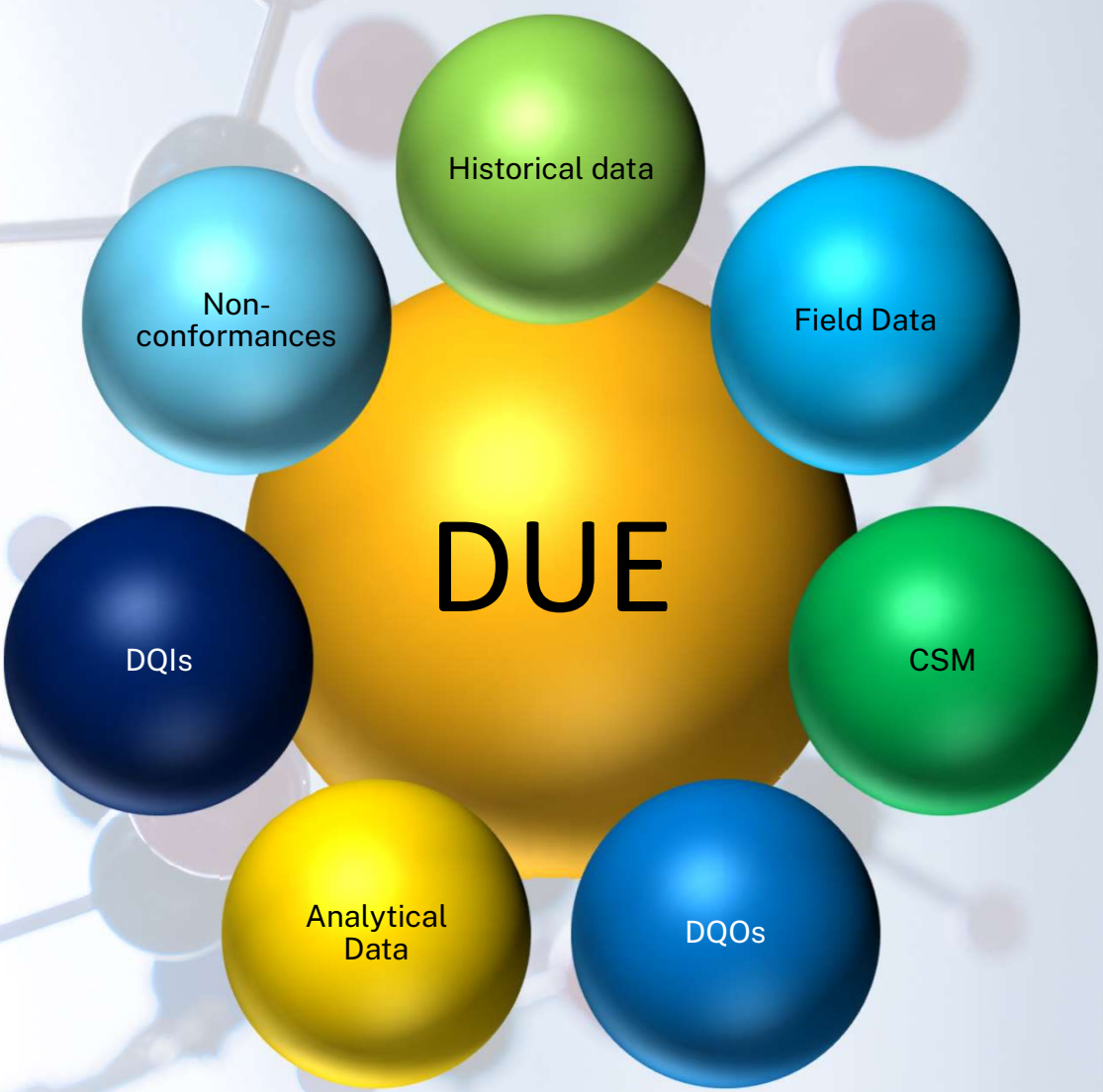
- Historical data – how does this data compare to historical results
- Field data – does field data clarify any non-conformances
- Other samples – how does data compare throughout release area/site
- CSM – does data validate or contradict the CSM
- DQOs – does data quality meet the intended purpose of the data

Is the non-conformance a result of:

- Dilution – e.g., diluted surrogate non-conformance
- Co-elution – e.g., data reported from dual column methods don't match due to co-eluting compounds
- Sample matrix issues – e.g., turbidity, heterogeneity, other reactive compounds in the sample

In summary…

The DUE process isn't just about lab reports, it's about assessing and evaluating all the data pertinent to your investigation.



DQA/DUE Summary

DQA Process

- Review Lab Certification Form
- Review the lab narratives
- Make sure “you got what you paid for”
- Documenting non-conformances

DUE Process

- Evaluating relevancy of data & non-conformances identified during DQA process
- Incorporating uncertainty into decision making
- Additional DUE considerations
- Can you justify the use of your data?

Quiz Break

DQA/DUE

POLL Q3-DQA/DUE

What are the general components of the DQA/DUE Process? (check all that apply)

- ✔ a. Documenting laboratory non-conformances
- ☐ b. Correcting reported concentrations by any reported biases
- ☐ c. Narrating field standard operating procedures
- ✔ d. Reviewing the RCP Lab Certification Form
- ☐ e. Rejecting any, and all, data with a reported bias
- ✔ f. Evaluating relevancy of non-conformances
- ✔ g. Consider intended use of the data with multiple lines of evidence

Q1-Surrogate Non-Conformance

- LEP Joe submitted two 1L ambers for 8270 analysis for standard TAT
- Criteria = SWPC
- COC = Benzo(a)anthrancene (SWPC = 0.3 µg/L).
- Non-conformance = surrogate recovery for this sample is outside of established control limits due to a sample matrix effect. The lab re-extracted and confirmed matrix interference, however, the re-extraction was performed outside holding time.
- The lab reported **both** sample results
  - (original) 0.26 µg/L; (re-extract) 0.29 µg/L
- Surrogate recoveries from lab report:

Lab ID	Client ID	Method	Compound	QC Outlier	%R or Blank Contaminant	RPD	Bias	Result	Units	SWPC
ABCDE-01	SW-02	SW846 8270	2,4,6-Tribromophenol	SUR	12(15-110)	-	Low		ug/L	0.3
ABCDE-01	SW-02	SW846 8270	Phenol-d5	SUR	14(15-110)	-	Low		ug/L	0.3
ABCDE-01RE1	SW-02	SW846 8270	2,4,6-Tribromophenol	SUR	14(15-110)		Low		ug/L	0.3

Q1 - CONTINUED

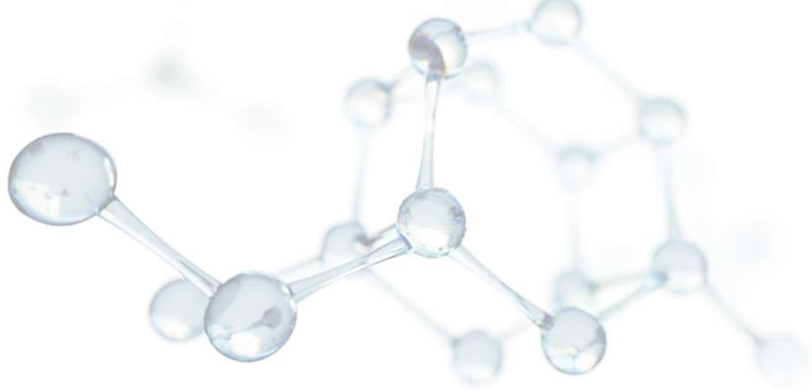
Required QC Parameter	Data Quality Objective	Required Performance Standard	Required Deliverable	Required Corrective Action	Required Analytical Response Action
Surrogates	Method Accuracy in Sample Matrix	(1) Minimum of 3 base-neutral surrogates and 3 acid surrogates, at retention times across GC run. Recommended base-neutral surrogates; nitrobenzene-d5, 2-fluorobiphenyl, p-terphenyl-d14. Recommended acid surrogates: phenol-d5, 2-fluorophenol, 2, 4, 6-tribromophenol. NOTE: For SIM analyses, surrogates used must be representative of compound class of target analytes (e.g., use base-neutral surrogates if analyzing for PAHs and use acid surrogates if analyzing for pentachlorophenol). (2) Soil percent recoveries within 30-130%. (3) Water percent recoveries within 30-130% for base-neutrals, 15-110% for acidic compounds.	Yes	If two or more surrogates fo any one class (base neutral or acid) are outside of limits or if any one surrogate recovers at <10% the following applies: (1) Re-extract the sample if surrogate recoveries are low (2) Re-extract the sample if surrogate recoveries are high and associated SVOCs were detected in the sample. Re-ext of the following exceptions applies: (a) If surrogate recoveries are high and target analytes are not detected in sample. (b) Re-extraction is not required if obvious interference present (e.g., UCM). If obvious interference is present and surrogate recovery would cause rejection of data (i.e., <10%), re-analyze sample with dilution. (c) If a surrogate is diluted to a concentration below that of the lowest calibration standard, re-extraction and/or reanalysis is not required.	(1) Report non-conformances in laboratory report narrative. (2) If re-extraction yields similar surrogate non-conformances, the lab must report results of both extractions. (3) If re-extraction is performed within holding time and yields acceptable surrogate recoveries the lab may report results of the re-extraction only. (4) If re-extraction is performed outside of the holding time and yields acceptable surrogate recoveries, the lab must report results of both extractions. (5) If sample is not re-extracted due to obvious interference, the laboratory must provide the chromatogram in the data report.

RCP 8270 Table 1A *(Ver. May 2024)*

Q1-Continued

True or False. The lab should have only reported the analytical results that were collected within the holding time.

- False. The lab appropriately reported both the results collected during and outside of the holding time per RCP 8270 Table 1A.



Q1-Continued

With the information provided by the laboratory, how would you evaluate the usability of the reported Benzo(a)anthracene results?

a. The Benzo(a)anthracene is below SWPC criteria, so it is usable.

b. The low bias reported in the surrogates and the narrative noting matrix interference indicates there is potential that the reported Benzo(a)anthracene concentration is under reported. Because it is close to criteria, the EP should assess if data is usable or if resampling is warranted.

c. The low bias reported in the surrogates and the narrative noting matrix interference indicates analytical failure and the data should be rejected.

Q2-LCS/LCSD Non-Conformance

- Groundwater sample submitted for 6010 analysis
- Criteria = GWPC
- COC = Barium (GWPC = 1,000 µg/L)
- Non-conformance = LCS/LCSD recoveries (83/79) for Barium outside acceptance criteria range of 85-115%; low bias
- Not enough sample volume left for re-digestion; EP requested lab report data regardless

Lab ID	Client ID	Method	Compound	QC Outlier	%R or Blank Contaminant	RPD	Bias	Result	Units	GWPC
ABCDE-01	GW-1	SW846 6010	Barium	LCS/LCSD	83/79 (85-115)	-	Low	985	ug/L	1,000

Q2-LCS/LCSD Non-Conformance

- Does the LCS/LCSD non-conformance for Barium automatically mean the data is not usable?
  - It depends! Because…
    - The intended use of the data matters!
      - If the EP is investigating absence/presence, this data could be usable
      - If the EP is trying to demonstrate clean-up to criteria, this data would be questionable because the reported sample concentration was relatively close to GWPC and the low Barium bias in the LCS/LCSD affects every sample run in the same batch

Lab ID	Client ID	Method	Compound	QC Outlier	%R or Blank Contaminant	RPD	Bias	Result	Units	GWPC
ABCDE-01	GW-1	SW846 6010	Barium	LCS/LCSD	83/79 (85-115)	-	Low	985	ug/L	1,000

Documenting the DQA/DUE Process

Presented by:

Roni Tanguay
DEEP | Remediation Division

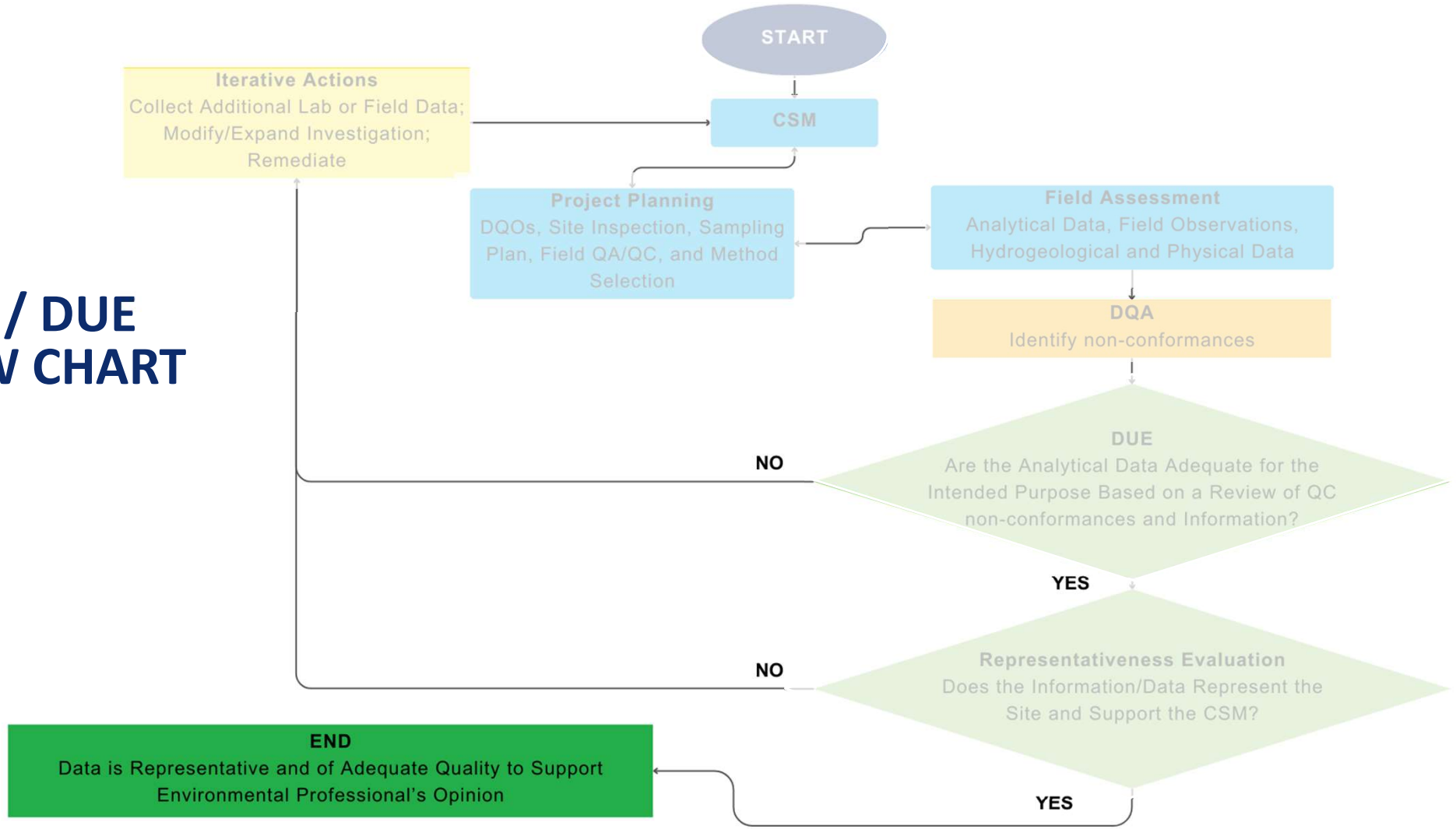
Kevin Vanderveer
DEEP | Remediation Division

Section Outline

Documentation

- Documentation Prep
- Concepts of Good DQA/DUE Documentation
- Components to include in reports
- Common Documentation Problems Received by DEEP
- Documentation Tips

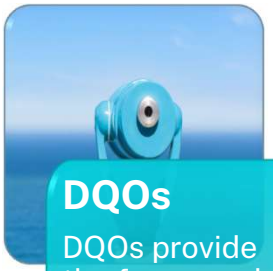
DQA / DUE FLOW CHART



DQA/DUE Documentation Begins *Before* Receiving Data

CSM

A CSM is necessary to define DQOs that will ultimately be used to support a DQA/DUE evaluation

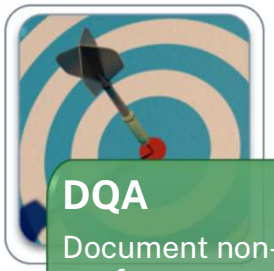


DQOs

DQOs provide the framework for collecting usable data & evaluating the acceptability of the data received

Collect Data

Take good notes, prepare clear chains of custody, document data collection methods and rationale



DQA

Document non-conformances in field and lab data and how they affect the data

DUE

Explain how the data can be used and identify any data gaps in the CSM arising from the DQA

Concepts of Good DQA/DUE Documentation

A well documented DQA/DUE narrative includes:

- **Understanding of, and appropriateness to, the project objectives**
  - Screening → Characterization → Compliance → Verification
  - Regulatory Criteria
- **Understanding of the Conceptual Site Model**
  - History of site, environmental setting, and quality of previous environmental data
  - Release mechanism, fate, and transport
  - Identification of data gaps
  - Representativeness and uniformity of samples collected
- **Discussion of essential non-conformances**
  - Evaluates precision, accuracy, and sensitivity of the data and how they may impact the usability of the data
  - Considers multiple lines of evidence
- **Explanation of possible impacts to data outside of laboratory analysis** (i.e., field QC deviations…)
- **Clear connection** between CSM, the analytical data, and final conclusions

Components to Include in Reports...

Summary and Evaluation

- Environmental data
- Field QA/QC deviations
- Laboratory non-conformances, case narrative
- Any other pertinent information

Supporting Documentation

- Laboratory Data and Laboratory Report Narratives (per RCP guidance)
- RCP QA/QC Certification Form
- Chain of Custody forms

Usability Discussion

- Demonstrate the usability of your data to support your conclusions using the summary & evaluation of environmental data and supporting documentation

DQA/DUE Structural Supports

- DQA/DUE tables that demonstrate non-conformances, compounds/samples affected by non-conformances, and the usability of the data.
- Checklists and Worksheets provided in the DEEP DQA/DUE Guidance Document

TIP!
There is no one perfect way to demonstrate DQA/DUE. Just "show your work"!

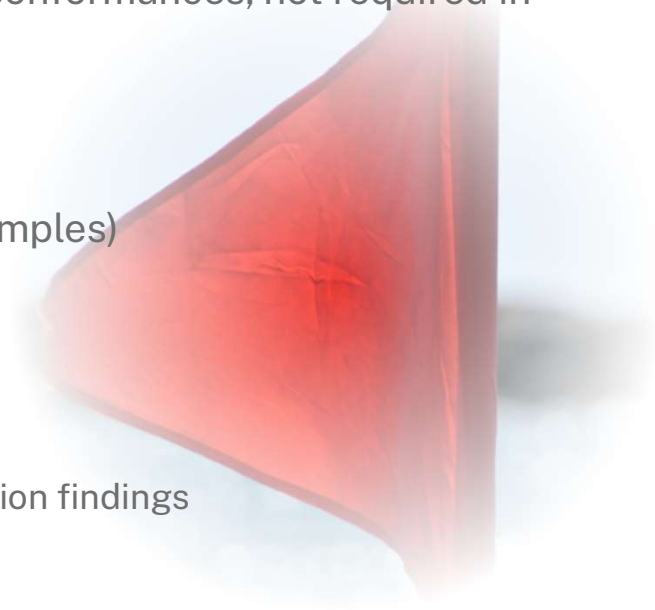
Common Documentation Problems Received by DEEP

Laboratory Report Issues

- Laboratory narrative cluttered with extra information, not just non-conformances, not required in RCP guidance

Environmental Professionals' Report Issues

- Incorrect use of method detection limit (MDL) instead of RL/LLOQ
- Reporting "J" flags when not applicable (for NON-drinking water samples)
- Treatment of non-detects
  - Need to evaluate context of presenting non-detects in EP report
  - "ND" does NOT demonstrate compliance if the RL/LLOQ > criteria
- Narratives
  - Rehash of lab narratives without context or lacks relevance to investigation findings
  - DQA/DUE narration is minimal, or not done at all
  - Narration of the data is verbose and circuitous
  - Lack of attention to reported biases (or attempts to correct biases)
- Correcting sample concentrations based on spike recoveries
- Interpretating data on sample-by-sample basis rather than by release area holistically



EP Reporting Tips

Tips for making DEEP review easier:

- Clearly indicate NDs and RLs
- Clearly indicate detections above criteria apart from NDs and RLs
- Double check table footnotes match formatting used to highlight data
- Max 20% reduction in text font on tables
- Group analytes by constituent class (i.e., metals, VOCs, SVOCs)
- Grouping samples by release area
- Double check site information (address, ID #s) on transmittal forms
- Proofread reports when reusing report templates
- Summarize non-conformances as briefly as possible in the text; provide the detail as backup in appendices
- Present DQA by sample so that all non-conformances affecting a sample are shown together

Documentation Summary

Documentation Prep	**DQA/DUE documentation begins *BEFORE* receiving data**
Good DQA/DUE Documentation	**Provides a good narrative from intro to conclusion including DQOs, CSM, non-conformances, and impacts of data bias**
Report Components	**Includes summarized non-conformances, data documentation, DQA/DUE, Appendices**
Common Documentation Pitfalls	**From excess information to not enough information**
Documentation Tips	**How to prepare reports to make DEEP review easier** **Proofread and double check the details**

Concluding Summary

Introduction to QA/QC Concepts

- Scientific method
- Data quality objectives
- Data quality and usability concepts

Understanding Environmental Data

- Quality assurance
- Data quality indicators
- PARCCS (precision, accuracy, etc.)

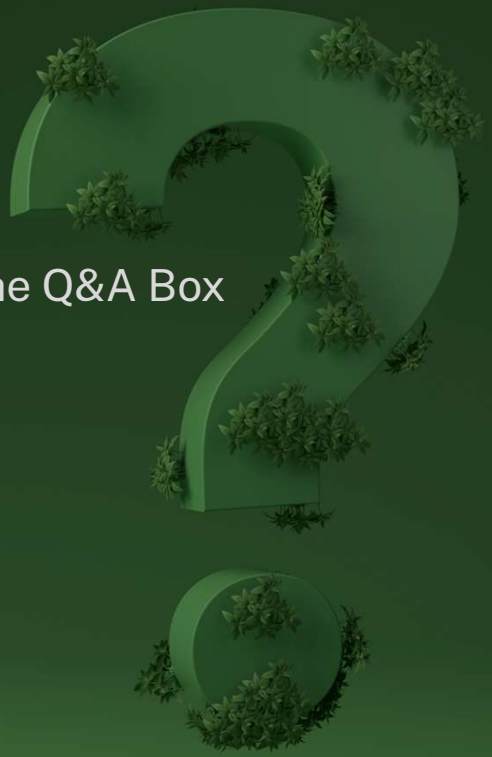
Data Quality Assessment and Useability

- Data quality assessment (DQA) process
- Data usability evaluation (DUE) process

Documenting Data Usability

- How to document DQA/DUE
- Common documentation problems
- Documentation tips

Questions?



Please type your questions into the Q&A Box

Case Study #1

Presented by:

Tina Clemmey
ENSAFE

Roni Tanguay
DEEP | Remediation Division

Case Study #1 Objectives

Walk through both DQA & DUE

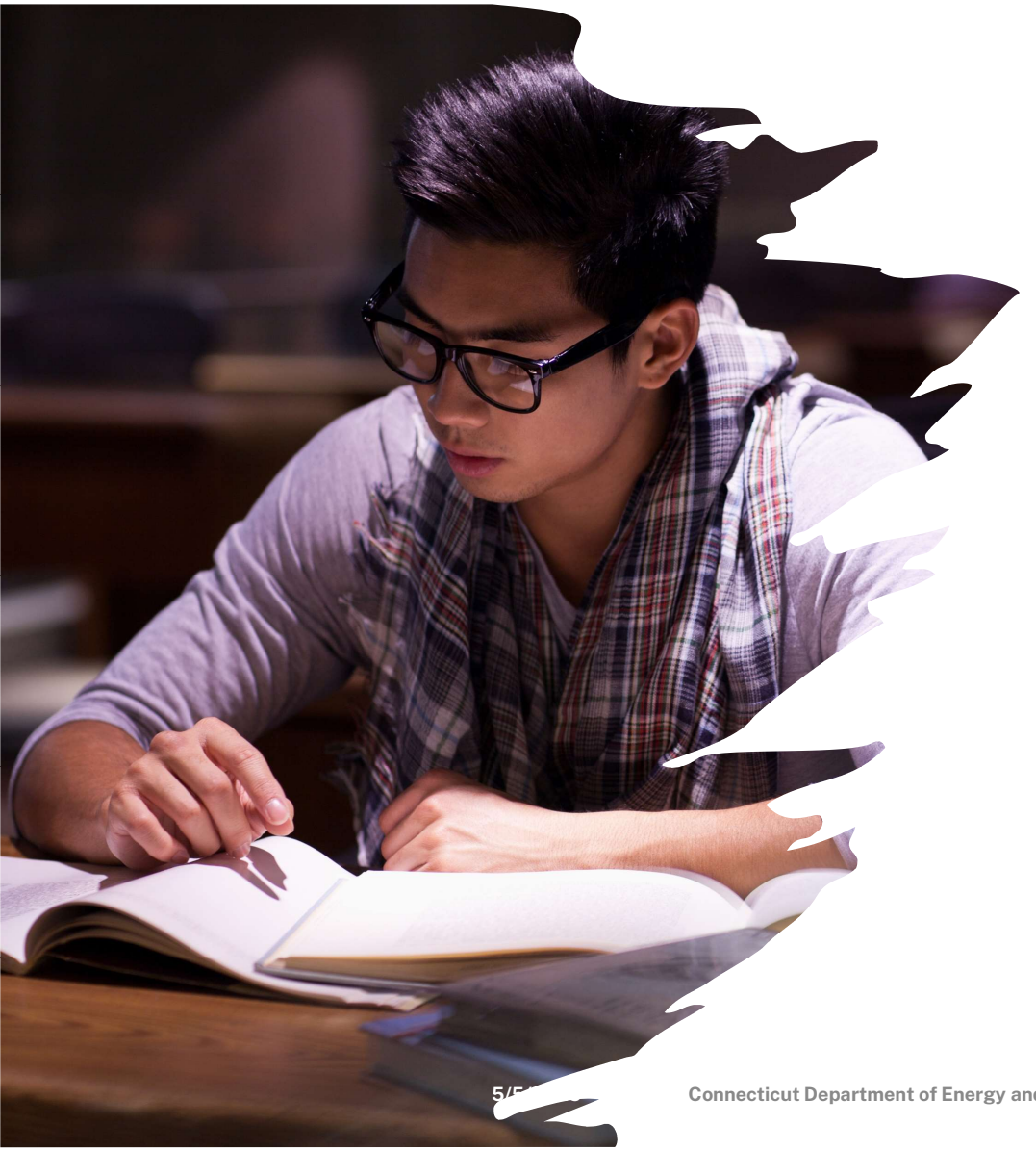
DQA process

- Finding non-conformances
- Documenting non-conformances in a worksheet

DUE process

- Fill out DUE worksheet with general non-conformance information

Compose DQA and DUE text for report using the data provided



Case Study Scenario

- Release from an in-ground wastewater treatment sump
- Release investigated and remediated
- Compliance groundwater (GW) monitoring initiated to determine if remediation was successful
- Data package contains the 1st quarter of GW data, subsequent GW sampling is scheduled
- Case study conditions:
  - **Site is exempt from meeting background for compliance**
  - **Analytical data will be compared to GWPC**

Case Study Data Package

- The following materials were included in the Data Package for this exercise, refer to these to follow along (out of 54 pages)
  - **RCP Certification Form – 4**
  - **Case Narrative – 5** & **6**
  - **Lab Report – 3 - 48**
  - **QC Report – 31 - 41**
  - **Batch Association – 44** & **45**
  - **Chain of Custody –47** & **48**
  - **DQA Worksheet – 49**
  - **DQA Summary Table – 50**
  - **DUE Worksheets – 51** & **52**
  - **DUE Text – 53**

DQA/DUE Process

DQA

- Identify and summarize QC nonconformances

DUE

- Determine if the quality of the data is sufficient for the intended purpose

Step 1: DQA

Documenting Non-Conformances

How Do You Complete a DQA?

Make sure you have everything you need to do the job

Data processing software

Data package

Site-related documents

Questions to ask as you prepare to do the DQA

Is the data package complete?

- If anything is missing, reach out to your lab!

How will you be documenting any non-conformances?

- Are you using excel, specialized software, pen and paper (not necessarily recommended)

Once you have everything you've answered the questions above, you're ready to GO!

Review the data package

Cross reference sample numbers with lab assigned sample IDs and batch numbers (Page 44 of 54)

Preparing DQA Worksheet

- For this exercise, we believe we have everything we need in the data package
- Before diving into the DQA process, we're going to set ourselves up with a table to document non-conformances as we navigate through the data package

Sample #	Lab ID	Location ID	Parameter	Non-conformance	%R or Blank Conc	Bias	Sample Result	Clean-up Criteria	Comments

Identifying Information

Non-conformances identified in the laboratory report

Other pertinent information for DUE purposes (which will get covered later)

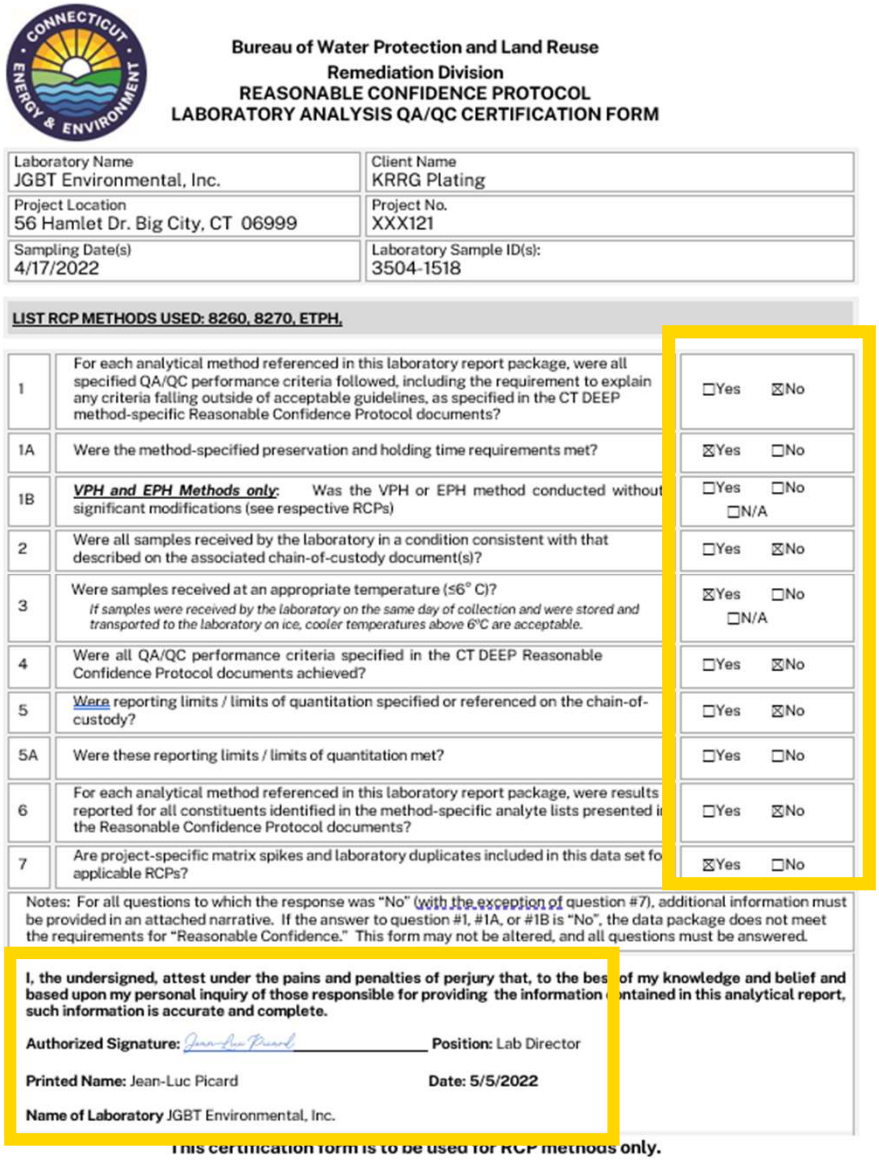
RCP Certification Form

Review RCP Certification form

- Are all the questions on the form answered?
- Is the RCP Certification Form signed?

NOTE: RCP Certification Form should **not** be modified

Page 4 of 54



Bureau of Water Protection and Land Reuse
Remediation Division
REASONABLE CONFIDENCE PROTOCOL
LABORATORY ANALYSIS QA/QC CERTIFICATION FORM

Laboratory Name: JGBT Environmental, Inc.	Client Name: KRRG Plating
Project Location: 56 Hamlet Dr. Big City, CT 06999	Project No.: XXX121
Sampling Date(s): 4/17/2022	Laboratory Sample ID(s): 3504-1518

LIST RCP METHODS USED: 8260, 8270, ETPH,

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEEP method-specific Reasonable Confidence Protocol documents?	☐Yes ☒No
1A	Were the method-specified preservation and holding time requirements met?	☒Yes ☐No
1B	***VPH and EPH Methods only***: Was the VPH or EPH method conducted without significant modifications (see respective RCPs)	☐Yes ☐No ☐N/A
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	☐Yes ☒No
3	Were samples received at an appropriate temperature (≤6° C)? *If samples were received by the laboratory on the same day of collection and were stored and transported to the laboratory on ice, cooler temperatures above 6°C are acceptable.*	☒Yes ☐No ☐N/A
4	Were all QA/QC performance criteria specified in the CT DEEP Reasonable Confidence Protocol documents achieved?	☐Yes ☒No
5	Were reporting limits / limits of quantitation specified or referenced on the chain-of-custody?	☐Yes ☒No
5A	Were these reporting limits / limits of quantitation met?	☐Yes ☐No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented i the Reasonable Confidence Protocol documents?	☐Yes ☒No
7	Are project-specific matrix spikes and laboratory duplicates included in this data set fo applicable RCPs?	☒Yes ☐No

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Reasonable Confidence." This form may not be altered, and all questions must be answered.

I, the undersigned, attest under the pains and penalties of perjury that, to the bes of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information ontained in this analytical report, such information is accurate and complete.

Authorized Signature: Jean-Luc Picard **Position:** Lab Director

Printed Name: Jean-Luc Picard **Date:** 5/5/2022

Name of Laboratory JGBT Environmental, Inc.

This certification form is to be used for RCP methods only.

RCP Certification Form

- Note which questions are answered “NO”
  - **Check the Case Narrative Report**
  - **Are these “NO” responses fully explained in the Case Narrative Report?**

No Sample or Holding Time Deficiencies

Question 1: “No” on RCP Certification Form - LCS lower than acceptance criteria for cadmium and copper, did not reanalyze as required by RCPs.

Question 2: “No” on RCP Certification Form – ETPH sample bottles broken in transit. Client notified.

Question 4: “No” on RCP Certification Form – Not all RCP Performance Criteria were met

Question 5: “No” on RCP Certification Form – RL not specified on COC

Question 6: “No” on Certification Form - Analyzed a partial list of metals listed in the RCP method as requested by the customer.

RCP Form-Page 4 of 54; Case Narrative-Page 5 of 54

Bureau of Water Protection and Land Reuse
Remediation Division
REASONABLE CONFIDENCE PROTOCOL
LABORATORY ANALYSIS QA/QC CERTIFICATION FORM

Laboratory Name: JGBT Environmental, Inc.	Client Name: KRRG Plating
Project Location: 56 Hamlet Dr. Big City, CT 06999	Project No.: XXX121
Sampling Date(s): 4/17/2022	Laboratory Sample ID(s): 3504-1518

LIST RCP METHODS USED: 8260, 8270, ETPH,

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEEP method-specific Reasonable Confidence Protocol documents?	☐Yes ☒No
1A	Were the method-specified preservation and holding time requirements met?	☒Yes ☐No
1B	***VPH and EPH Methods only***: Was the VPH or EPH method conducted without significant modifications (see respective RCPs)	☐Yes ☐No ☐N/A
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	☐Yes ☒No
3	Were samples received at an appropriate temperature (≤6° C)? *If samples were received by the laboratory on the same day of collection and were stored and transported to the laboratory on ice, cooler temperatures above 6°C are acceptable.*	☒Yes ☐No ☐N/A
4	Were all QA/QC performance criteria specified in the CT DEEP Reasonable Confidence Protocol documents achieved?	☐Yes ☒No
5	Were reporting limits / limits of quantitation specified or referenced on the chain-of-custody?	☐Yes ☒No
5A	Were these reporting limits / limits of quantitation met?	☐Yes ☐No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the Reasonable Confidence Protocol documents?	☐Yes ☒No
7	Are project-specific matrix spikes and laboratory duplicates included in this data set for applicable RCPs?	☒Yes ☐No

Notes: For all questions to which the response was “No” (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A, or #1B is “No”, the data package does not meet the requirements for “Reasonable Confidence.” This form may not be altered, and all questions must be answered.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete.

Authorized Signature: _____ **Position:** Lab Director

Printed Name: Jean-Luc Picard **Date:** 5/5/2022

Name of Laboratory JGBT Environmental, Inc.

This certification form is to be used for RCP methods only.

RCP Certification Form

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Reasonable Confidence." This form may not be altered, and all questions must be answered.

- Question 1 = "NO"
- Reasonable confidence **not** achieved!
- This doesn't mean data isn't usable, it depends
- Need to **carefully** review & assess data quality & usability

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Chain of Custody Evaluation

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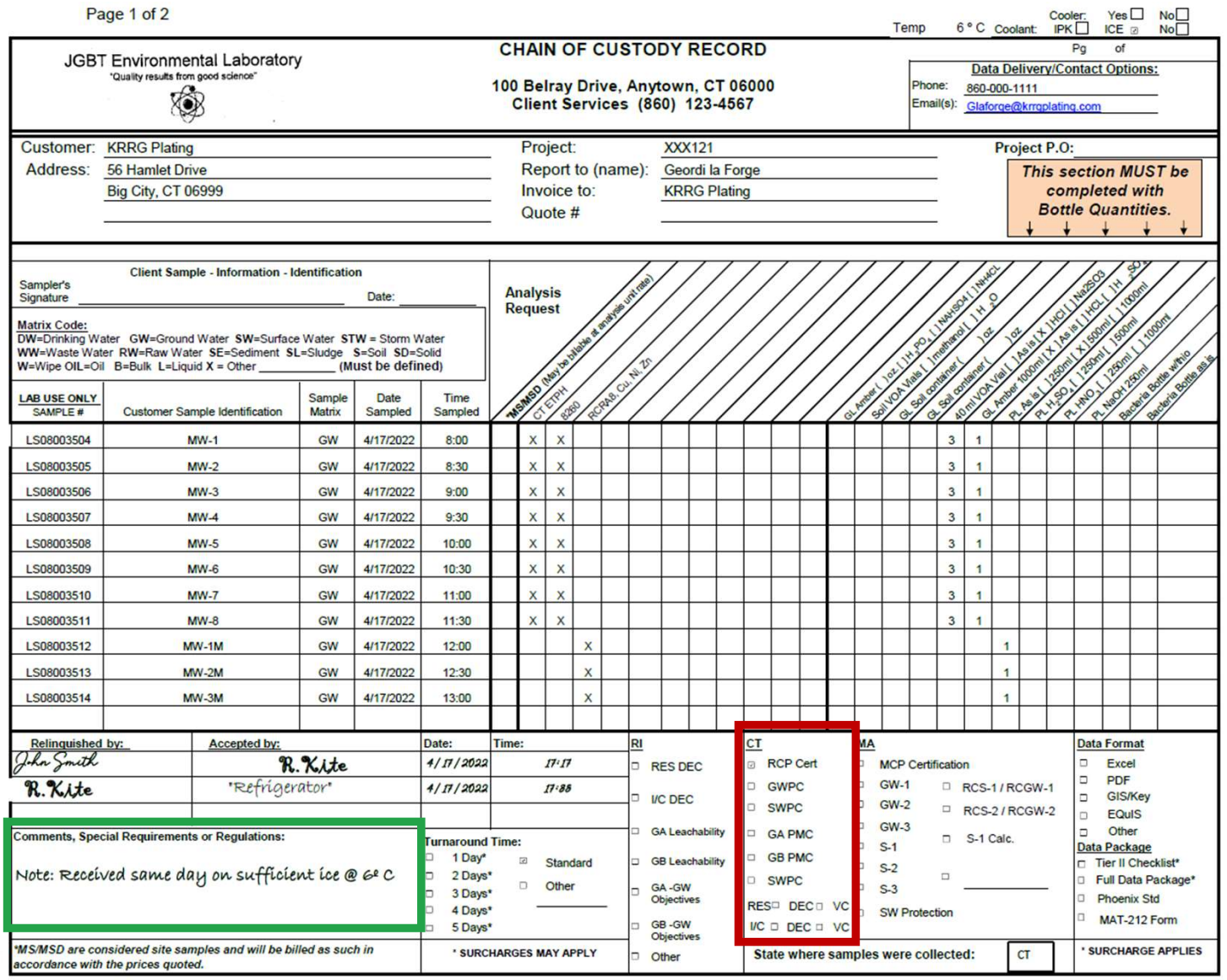
Were samples appropriately preserved/refrigerated/iced?

What criteria were noted on the Chain of Custody?

- In this case, GWPC should have been noted so that the lab understood the targeted RLs. EP is responsible for assessing final RLs against criteria.



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Temp 6 ° C Coolant: Cooler: Yes ☐ No ☐ IPK ☐ ICE ☑ No ☐

Pg of

JGBT Environmental Laboratory
"Quality results from good science"

CHAIN OF CUSTODY RECORD

100 Belray Drive, Anytown, CT 06000
Client Services (860) 123-4567

Data Delivery/Contact Options:
Phone: 860-000-1111
Email(s): Glaforge@krrgplating.com

Customer: KRRG Plating
Address: 56 Hamlet Drive
Big City, CT 06999

Project: XXX121
Report to (name): Geordi la Forge
Invoice to: KRRG Plating
Quote #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification
Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water STW = Storm Water
WW=Waste Water RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid
W=Wipe OIL=Oil B=Bulk L=Liquid X = Other _____ (Must be defined)

Analysis Request

LAB USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	*MS/MSD (May be billable at analysis unit rate)	CT ETPH	8260	RCRA8, Cu, Ni, Zn	GL Amber ( ) oz [ ] H_3PO_4 [ ] NaHSO4 [ ] NHCL	Soil VOA Vials [ ] methanol [ ] H_2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [X] HCl [ ] Na_2SO_3	GL Amber 1000ml [X] As is [ ] HCl [ ] HCL [ ] H_2SO_4	PL As is [250ml [X] As is [ ] 500ml [ ] 1000ml	PL H_2SO_4 [ ] 250ml [ ] 500ml [ ] 1000ml	PL HNO_3 [ ] 250ml [ ] 1000ml	PL NaOH 250ml	Bacteria Bottle w/hio	Bacteria Bottle as is
LS08003504	MW-1	GW	4/17/2022	8:00		X	X				3	1							
LS08003505	MW-2	GW	4/17/2022	8:30		X	X				3	1							
LS08003506	MW-3	GW	4/17/2022	9:00		X	X				3	1							
LS08003507	MW-4	GW	4/17/2022	9:30		X	X				3	1							
LS08003508	MW-5	GW	4/17/2022	10:00		X	X				3	1							
LS08003509	MW-6	GW	4/17/2022	10:30		X	X				3	1							
LS08003510	MW-7	GW	4/17/2022	11:00		X	X				3	1							
LS08003511	MW-8	GW	4/17/2022	11:30		X	X				3	1							
LS08003512	MW-1M	GW	4/17/2022	12:00				X							1				
LS08003513	MW-2M	GW	4/17/2022	12:30				X							1				
LS08003514	MW-3M	GW	4/17/2022	13:00				X							1				

Relinquished by:	Accepted by:	Date:	Time:
John Smith	R. Kite	4/17/2022	17:17
R. Kite	"Refrigerator"	4/17/2022	17:88

Comments, Special Requirements or Regulations:
Note: Received same day on sufficient ice @ 6° C

Turnaround Time:
☐ 1 Day* ☐ 2 Days* ☐ 3 Days* ☐ 4 Days* ☐ 5 Days*
☑ Standard ☐ Other _____

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

* SURCHARGES MAY APPLY

RI
☐ RES DEC
☐ I/C DEC
☐ GA Leachability
☐ GB Leachability
☐ GA -GW Objectives
☐ GB -GW Objectives
☐ Other

CT
☑ RCP Cert
☐ GWPC
☐ SWPC
☐ GA PMC
☐ GB PMC
☐ SWPC
RES☐ DEC☐ VC
I/C ☐ DEC ☐ VC

MA
☐ MCP Certification
☐ GW-1 ☐ RCS-1 / RCGW-1
☐ GW-2 ☐ RCS-2 / RCGW-2
☐ GW-3 ☐ S-1 Calc.
☐ S-1
☐ S-2 ☐ _____
☐ S-3
☐ SW Protection

State where samples were collected: CT

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist*
☐ Full Data Package*
☐ Phoenix Std
☐ MAT-212 Form

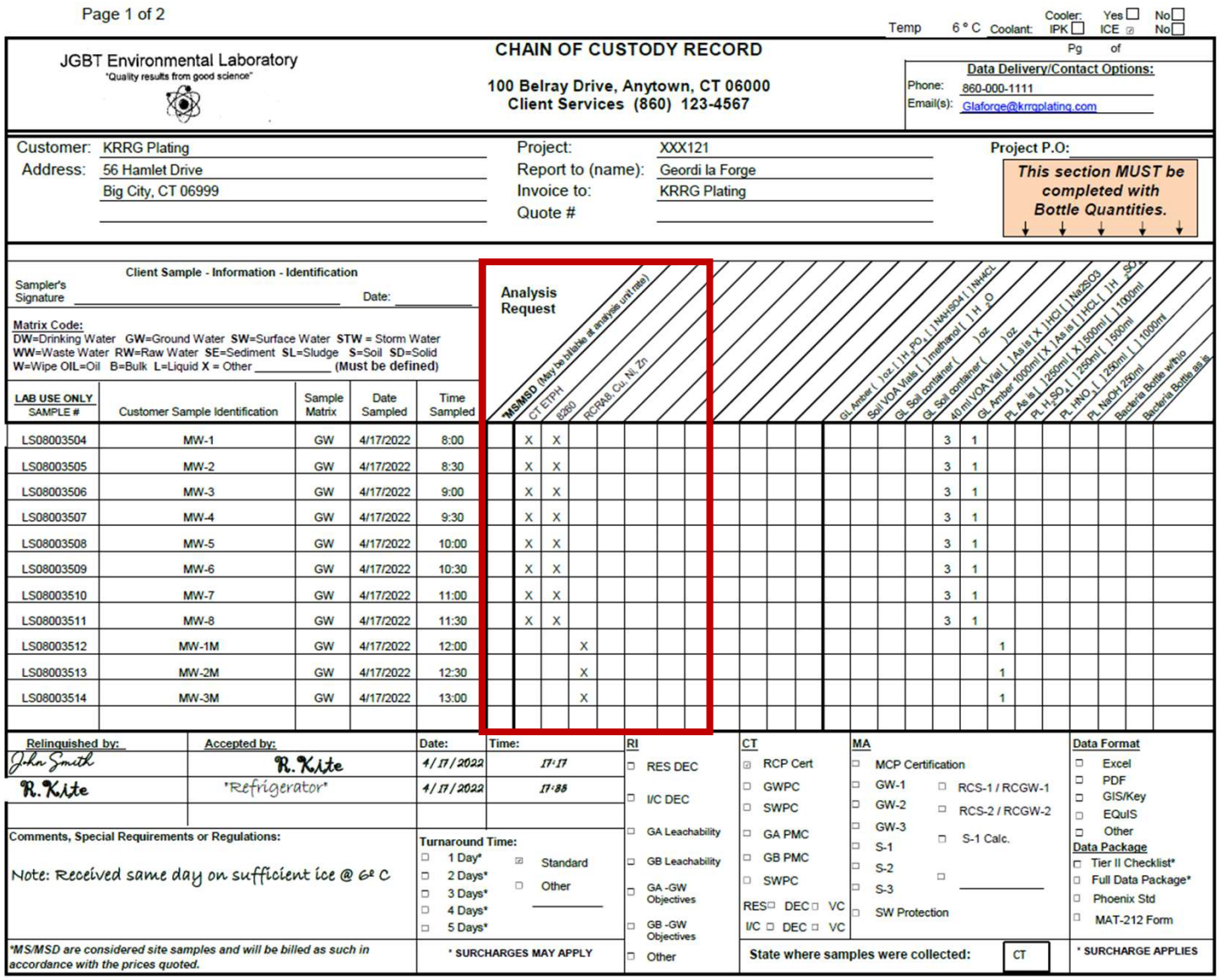
* SURCHARGE APPLIES

Chain of Custody Evaluation

Page 47 & 48 of 54

Were all analyses performed per the Chain of Custody?

- DQA Note! Review of the analytical results will show that two samples were not analyzed for ETPH as requested on the Chain of Custody



Page 1 of 2

Temp 6 ° C Coolant: Cooler: Yes ☐ No ☐ IPK ☐ ICE ☑ No ☐

Pg of

JGBT Environmental Laboratory
"Quality results from good science"

CHAIN OF CUSTODY RECORD

100 Belray Drive, Anytown, CT 06000
Client Services (860) 123-4567

Data Delivery/Contact Options:
Phone: 860-000-1111
Email(s): Glaforge@krrgplating.com

Customer: KRRG Plating
Address: 56 Hamlet Drive
Big City, CT 06999

Project: XXX121
Report to (name): Geordi la Forge
Invoice to: KRRG Plating
Quote #

Project P.O:

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water GW=Ground Water SW=Surface Water STW = Storm Water
WW=Waste Water RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid
W=Wipe OIL=Oil B=Bulk L=Liquid X = Other _____ (Must be defined)

Analysis Request

LAB USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	*MS/MSD (May be billable at analysis unit rate)	CT ETPH	8260	RCRA8, Cu, Ni, Zn	GL Amber ( ) oz [ ] H_3PO_4 [ ] NaHSO4 [ ] NaHCL	Soil VOA Vials [ ] methanol [ ] H_2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [X] HCl [ ] Na_2SO_3	GL Amber 1000ml [X] As is [ ] HCl [ ] NaOH [ ] H_2SO_4	PL As is [ ] 250ml [X] 500ml [ ] 1000ml	PL H_2SO_4 [ ] 250ml [ ] 500ml [ ] 1000ml	PL HNO_3 [ ] 250ml [ ] 500ml [ ] 1000ml	PL NaOH 250ml	Bacteria Bottle w/hio	Bacteria Bottle as is
LS08003504	MW-1	GW	4/17/2022	8:00		X	X				3	1								
LS08003505	MW-2	GW	4/17/2022	8:30		X	X				3	1								
LS08003506	MW-3	GW	4/17/2022	9:00		X	X				3	1								
LS08003507	MW-4	GW	4/17/2022	9:30		X	X				3	1								
LS08003508	MW-5	GW	4/17/2022	10:00		X	X				3	1								
LS08003509	MW-6	GW	4/17/2022	10:30		X	X				3	1								
LS08003510	MW-7	GW	4/17/2022	11:00		X	X				3	1								
LS08003511	MW-8	GW	4/17/2022	11:30		X	X				3	1								
LS08003512	MW-1M	GW	4/17/2022	12:00				X							1					
LS08003513	MW-2M	GW	4/17/2022	12:30				X							1					
LS08003514	MW-3M	GW	4/17/2022	13:00				X							1					

Relinquished by:	Accepted by:	Date:	Time:
John Smith	R. Kite	4/17/2022	17:17
R. Kite	"Refrigerator"	4/17/2022	17:88

Comments, Special Requirements or Regulations:

Note: Received same day on sufficient ice @ 6° C

Turnaround Time:
☐ 1 Day* ☐ 2 Days* ☐ 3 Days* ☐ 4 Days* ☐ 5 Days*
☑ Standard ☐ Other _____

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

* SURCHARGES MAY APPLY

RI
☐ RES DEC
☐ I/C DEC
☐ GA Leachability
☐ GB Leachability
☐ GA -GW Objectives
☐ GB -GW Objectives
☐ Other

CT
☑ RCP Cert
☐ GWPC
☐ SWPC
☐ GA PMC
☐ GB PMC
☐ SWPC
RES☐ DEC☐ VC
I/C ☐ DEC ☐ VC

MA
☐ MCP Certification
☐ GW-1 ☐ RCS-1 / RCGW-1
☐ GW-2 ☐ RCS-2 / RCGW-2
☐ GW-3 ☐ S-1 ☐ S-1 Calc.
☐ S-2 ☐ _____
☐ S-3
☐ SW Protection

State where samples were collected: CT

Data Format
☐ Excel
☐ PDF
☐ GIS/Key
☐ EQuIS
☐ Other

Data Package
☐ Tier II Checklist*
☐ Full Data Package*
☐ Phoenix Std
☐ MAT-212 Form

* SURCHARGE APPLIES

Checking Sample Results for Analyses Completed

REPORT ON LABORATORY EXAMINATIONS

Laboratory No.: LS08003506 **Client Sample ID:** MW-3

Sample Matrix: Groundwater **Received Date:** Thursday, April 17, 2022

Collected By:ENVIROBIZ, INC. **Collect Date:**Thursday, April 17, 2022

Source:KRRG Plating, Big City, CT

Sample ID: Monitoring Well Sample

Analysis Method: ETPH **Prep By:** jl **Prep Date:** 4/22/2022 **Prep Batch:** 5801

	Test	Result	Units	Dil	RL	Analyst	Analysis Date	Batch #
LS08003506	ETPH	ND	µg/L	1	73	MK	4/27/2022	45137

Analysis Method: SW-846 8260D

	Test	Result	Units	Dil	RL
LS08003506	Acetone	ND	µg/L	1	10.

REPORT ON LABORATORY EXAMINATIONS

Laboratory No.: LS08003507 **Client Sample ID:** MW-4

Sample Matrix: Groundwater **Received Date:** Thursday, April 17, 2022

Collected By:ENVIROBIZ, INC. **Collect Date:**Thursday, April 17, 2022

Source:KRRG Plating, Big City, CT

Sample ID: Monitoring Well Sample

ETPH Data should be here

Analysis Method: SW-846 8260D

	Test	Result	Units	Dil	RL	Analyst	Analysis Date	Batch #
LS08003507	Acetone	ND	µg/L	1	10.0	MS	4/30/2022	45165

5/5/2025

Pages 8 through 31

DQA Worksheet

- Enter non-conformances identified between the Chain of Custody & lab report

Sample #	Lab ID	Location ID	Parameter	Non-conformance	%R or Blank Conc	Bias	Sample Result	Clean-up Criteria	Comments
MW-4	LS08003507	MW-4	ETPH	No result reported					ETPH not analyzed as requested. Sample bottles broken in transit
MW-7	LS08003510	MW-7	ETPH	No result reported					ETPH not analyzed as requested. Sample bottles broke in transit

Reviewing the Laboratory Narrative

- Review the narrative for findings (i.e., QC non-conformances)
  - **Labs are a good resource if you need additional assistance with data interpretation**
- Add any identified non-conformances to the DQA worksheet

CASE NARRATIVE REPORT CONTINUED

Volatile Organic Compounds - Method 8260

The laboratory control sample (LCS) for batch 45165 exceeded control limits for percent recovery (%R) for 1,1,2,2-tetrachloroethane (60%).

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003511M had several VOCs outside the acceptance limits for %R and or relative percent difference (RPD).

Inorganic Metals - Method 6010

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003513 had cadmium recovered outside the acceptance limits for %R. A %R of 50.91 was reported for the spike and a %R of 56.47 for the spike duplicate.

The method blank associated with batch 45066 had zinc detected at a concentration that was above the reporting limit. All samples associated with the method blank that have detections for these metals have been flagged with a "B."

The LCS for prep batch 5797 exceeded control limits for cadmium (57.47%) and copper (60.93%).

ETPH – Extractable Total Petroleum Hydrocarbons

The surrogate n-pentacosane had a high %R (153%) for sample LS08003504.

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Narrative Non-Conformances

- VOC LCS non-conformance
- VOC MS/MSD non-conformance

- Metals MS/MSD non-conformances
- Zinc detected in method blank
- Metals LCS non-conformances

- ETPH surrogate non-conformance

CASE NARRATIVE REPORT CONTINUED

Volatile Organic Compounds - Method 8260

The laboratory control sample (LCS) for batch 45165 exceeded control limits for percent recovery (%R) for 1,1,2,2-tetrachloroethane (60%).

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003511M had several VOCs outside the acceptance limits for %R and or relative percent difference (RPD).

Inorganic Metals - Method 6010

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003513 had cadmium recovered outside the acceptance limits for %R. A %R of 50.91 was reported for the spike and a %R of 56.47 for the spike duplicate.

The method blank associated with batch 45066 had zinc detected at a concentration that was above the reporting limit. All samples associated with the method blank that have detections for these metals have been flagged with a "B."

The LCS for prep batch 5797 exceeded control limits for cadmium (57.47%) and copper (60.93%).

ETPH – Extractable Total Petroleum Hydrocarbons

The surrogate n-pentacosane had a high %R (153%) for sample LS08003504.

DQA Worksheet

Sample #	Lab ID	Location ID	Parameter	Non-conformance	%R or Blank Conc	Bias	Sample Result	Clean-up Criteria	Comments
MW-4	LS08003507	MW-4	ETPH	No result reported					ETPH not analyzed as requested. Sample bottles broken in transit
MW-7	LS08003510	MW-7	ETPH	No result reported					ETPH not analyzed as requested. Sample bottles broken in transit
-	-	-	1,1,2,2,-tetrachloroethane	LCS %R	60%	Low		GWPC	Batch 45165
MW-8	LS08003511M	MW-8	VOCs	MS/MSD		Low			%R & RPD
MW-2m	LS08003513	MW-2m	Cadmium	MS/MSD	50.91 56.47	Low	4 µg/L	GWPC=5 µg/L SWPC=6 µg/L	Sample Result
-	-	-	Zinc	Method Blank	0.01 mg/L				Batch 45066
-	-	-	Cadmium	LCS %R	57.47%	Low			Batch 5797
-	-	-	Copper	LCS %R	60.93%	Low			Batch 5797
MW-1	LS08003504	MW-1	ETPH	Surrogate %R	153%	High			n-pentacosane

Blank Non-Conformance

- Blank was associated with **Batch** # 45066
- Applies to samples MW-1m through MW-6m, but not MW-7m

SAMPLE NUMBER, ANALYSIS BATCH AND PREP BATCH ASSOCIATION

Report #: 08R-2469.0 **Report Date:** 5/5/2022

Analysis Method: ETPH

Lab #	Client ID #	Analysis Batch #	Prep Batch #
LS08003504	MW-1	45137	5801
LS08003505	MW-2	45137	5801
LS08003506	MW-3	45137	5801
LS08003508	MW-5	45137	5801
LS08003509	MW-6	45137	5801
LS08003511	MW-8	45137	5801

Analysis Method: SW-846 6010D

Lab #	Client ID #	Analysis Batch #	Prep Batch #
LS08003512	MW-1m	45066	5795
LS08003513	MW-2m	45066	5795
LS08003514	MW-3m	45066	5795
LS08003515	MW-4m	45066	5795
LS08003516	MW-5m	45066	5795
LS08003517	MW-6m	45066	5795
LS08003518	MW-7m	45085	5797

Blank Non-Conformance Continued

QC REPORT

Report #: 08R-2469.0

Report Date: 5/5/2022

Blanks

QC Number	Test Name	Analysis Batch #	Blank Result	% Rec	RPD	Low Limit	High Limit	Analysis Date	Prep Batch #	Method
Blank	Mercury	45044	ND				0.0002 mg/L	4/22/2022	5794	SW-846 7470A
Blank	Arsenic	45046	ND				0.004 mg/L	4/22/2022	5795	SW-846 7010
Blank	Lead	45060	ND				0.01 mg/L	4/23/2022	5795	SW-846 7010
Blank	Barium	45066	ND				0.005 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Cadmium	45066	ND				0.005 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Chromium, Total	45066	ND				0.01 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Copper	45066	ND				0.01 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Lead	45066	ND				0.01 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Nickel	45066	ND				0.005 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Selenium	45066	ND				0.01 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Silver	45066	ND				0.005 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Zinc	45066	0.01*				0.01 mg/L	4/23/2022	5795	SW-846 6010D
Blank	Lead	45072	ND				0.005 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Barium	45085	ND				0.02 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Cadmium	45085	ND				0.002 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Chromium, Total	45085	ND				0.005 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Copper	45085	ND				0.005 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Lead	45085	ND				0.01 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Nickel	45085	ND				0.01 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Selenium	45085	ND				0.01 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Silver	45085	ND				0.005 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Zinc	45085	ND				0.01 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Antimony	45091	ND				0.006 mg/L	4/24/2022	5797	SW-846 7010
Blank	Beryllium	45091	ND				0.001 mg/L	4/24/2022	5797	SW-846 7010
Blank	Cadmium	45091	ND				0.002 mg/L	4/24/2022	5797	SW-846 6010D
Blank	Calcium	45091	ND				0.2 mg/L	4/24/2022	5797	SW-846 7010
Blank	Chromium, Total	45091	ND				0.005 mg/L	4/24/2022	5797	SW-846 7010
Blank	Copper	45091	ND				0.005 mg/L	4/24/2022	5797	SW-846 7010

DQA Worksheet

Sample #	Lab ID	Location ID	Parameter	Non-conformance	%R or Blank Conc	Bias	Sample Result	Clean-up Criteria	Comments
-	-	-	Zinc	Method Blank					Batch 45066
MW-1m	LS08003512	MW-1m	Zinc	Method Blank	0.01 mg/L in blank		ND <0.01	GWPC = 5 mg/L	
MW-2m	LS08003513	MW-2m	Zinc	Method Blank	0.01 mg/L in blank		ND <0.01	GWPC = 5 mg/L	
MW-3m	LS08003514	MW-3m	Zinc	Method Blank	0.01 mg/L in blank		ND <0.01	GWPC = 5 mg/L	
MW-4m	LS08003515	MW-4m	Zinc	Method Blank	0.01 mg/L in blank		**0.029**	GWPC = 5 mg/L	Sample result <10x of the blank conc. Potential artifact from blank*
MW-5m	LS08003516	MW-5m	Zinc	Method Blank	0.01 mg/L in blank		ND <0.01	GWPC = 5 mg/L	
MW-6m	LS08003517	MW-6m	Zinc	Method Blank	0.01 mg/L in blank		**0.180**	GWPC = 5 mg/L	Sample result >10x of the blank conc. Confirmed detection.

*Zinc is a common laboratory contaminant – assess concentration reported in sample compared to criteria
Consider if there is historical data indicating Zinc as a constituent of concern

Narrative Non-Conformances

- VOC LCS non-conformance
- VOC MS/MSD non-conformance

- Metals MS/MSD non-conformances
- Zinc detected in method blank
- Metals LCS non-conformances

- ETPH surrogate non-conformance

CASE NARRATIVE REPORT CONTINUED

Volatile Organic Compounds - Method 8260

The laboratory control sample (LCS) for batch 45165 exceeded control limits for percent recovery (%R) for 1,1,2,2-tetrachloroethane (60%).

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003511M had several VOCs outside the acceptance limits for %R and or relative percent difference (RPD).

Inorganic Metals - Method 6010

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003513 had cadmium recovered outside the acceptance limits for %R. A %R of 50.91 was reported for the spike and a %R of 56.47 for the spike duplicate.

The method blank associated with batch 45066 had zinc detected at a concentration that was above the reporting limit. All samples associated with the method blank that have detections for these metals have been flagged with a "B."

The LCS for prep batch 5797 exceeded control limits for cadmium (57.47%) and copper (60.93%).

ETPH – Extractable Total Petroleum Hydrocarbons

The surrogate n-pentacosane had a high %R (153%) for sample LS08003504.

LCS Non-Conformance

- LCS associated with **Batch # 5797** recovered below RCP acceptance criteria
- Only applies to MW-7m based on Prep Batch # 5797

SAMPLE NUMBER, ANALYSIS BATCH AND PREP BATCH ASSOCIATION

Report #: 08R-2469.0 **Report Date:** 5/5/2022

Analysis Method: ETPH

Lab #	Client ID #	Analysis Batch #	Prep Batch #
LS08003504	MW-1	45137	5801
LS08003505	MW-2	45137	5801
LS08003506	MW-3	45137	5801
LS08003508	MW-5	45137	5801
LS08003509	MW-6	45137	5801
LS08003511	MW-8	45137	5801

Analysis Method: SW-846 6010D

Lab #	Client ID #	Analysis Batch #	Prep Batch #
LS08003512	MW-1m	45066	5795
LS08003513	MW-2m	45066	5795
LS08003514	MW-3m	45066	5795
LS08003515	MW-4m	45066	5795
LS08003516	MW-5m	45066	5795
LS08003517	MW-6m	45066	5795
LS08003518	MW-7m	45085	5797

Page 44 of 54

LCS Non-Conformance Continued

Laboratory Control Samples

QC Number	Test Name	Batch #	Blank Result	% Rec	RPD	Low Limit	High Limit	Analysis Date	Prep Batch #	Method
LCS	Mercury	45044		102.98		85 -	115%	4/22/2022	5794	SW-846 7470A
LCS	Arsenic	45046		102.3		85 -	115%	4/22/2022	5795	SW-846 7010
LCS	Lead, SPLP	45060		96.45		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Barium	45066		95.85		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Cadmium	45066		96.73		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Chromium, Total	45066		98.4		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Copper	45066		100.83		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Lead	45066		96.45		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Nickel	45066		98.3		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Selenium	45066		99.2		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Silver	45066		97.87		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Zinc	45066		102.6		85 -	115%	4/23/2022	5795	SW-846 6010D
LCS	Lead	45072		107.28		85 -	115%	4/24/2022	5797	SW-846 6010D
LCS	Barium	45085		102.1		85 -	115%	4/24/2022	5797	SW-846 6010D
LCS	Cadmium	45085		57.47*		85 -	115%	4/24/2022	5797	SW-846 6010D
LCS	Chromium, Total	45085		99.15		85 -	115%	4/24/2022	5797	SW-846 6010D
LCS	Copper	45085		60.93*		85 -	115%	4/24/2022	5797	SW-846 6010D

DQA Worksheet

Sample #	Lab ID	Location ID	Parameter	Non-conformance	%R or Blank Conc	Bias	Sample Result	Clean-up Criteria	Comments
MW-2m	LS08003513	MW-2m	Zinc	Method Blank	0.01 mg/L in blank		ND <0.01		
MW-3m	LS08003514	MW-3m	Zinc	Method Blank	0.01 mg/L in blank		ND <0.01		
MW-4m	LS08003515	MW-4m	Zinc	Method Blank	0.01 mg/L in blank		**0.029**		Sample result <10x of the blank conc. Potential artifact from blank*
MW-5m	LS08003516	MW-5m	Zinc	Method Blank	0.01 mg/L in blank		ND <0.01		
MW-6m	LS08003517	MW-6m	Zinc	Method Blank	0.01 mg/L in blank		**0.180**		Sample result >10x of the blank conc. Confirmed detection.
MW-7m	LS08003518	MW-7m	Cadmium	LCS	57.47	Low	0.005 mg/L	GWPC = 0.005 mg/L	LCS not reanalyzed by laboratory
MW-7m	LS08003518	MW-7m	Copper	LCS	60.93	Low	0.047 mg/L	GWPC = 1.3 mg/L	LCS not reanalyzed by laboratory

Narrative Non-Conformances

- VOC LCS non-conformance
- VOC MS/MSD non-conformance

- Metals MS/MSD non-conformances
- Zinc detected in method blank
- Metals LCS non-conformances

- ETPH surrogate non-conformance

CASE NARRATIVE REPORT CONTINUED

Volatile Organic Compounds - Method 8260

The laboratory control sample (LCS) for batch 45165 exceeded control limits for percent recovery (%R) for 1,1,2,2-tetrachloroethane (60%).

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003511M had several VOCs outside the acceptance limits for %R and or relative percent difference (RPD).

Inorganic Metals - Method 6010

The matrix spike/matrix spike duplicate (MS/MSD) associated with sample LS08003513 had cadmium recovered outside the acceptance limits for %R. A %R of 50.91 was reported for the spike and a %R of 56.47 for the spike duplicate.

The method blank associated with batch 45066 had zinc detected at a concentration that was above the reporting limit. All samples associated with the method blank that have detections for these metals have been flagged with a "B."

The LCS for prep batch 5797 exceeded control limits for cadmium (57.47%) and copper (60.93%).

ETPH – Extractable Total Petroleum Hydrocarbons

The surrogate n-pentacosane had a high %R (153%) for sample LS08003504.

Surrogate Non-Conformance

- Check the sample number, analysis batch, and prep batch association page
- Look at Lab # LS08003504 to find the corresponding groundwater sample ID
  - **Associated with MW-1**

SAMPLE NUMBER, ANALYSIS BATCH AND PREP BATCH ASSOCIATION

Report #: 08R-2469.0 **Report Date:** 5/5/2022

Analysis Method: ETPH

Lab #	Client ID #	Analysis Batch #	Prep Batch #
LS08003504	MW-1	45137	5801
LS08003505	MW-2	45137	5801
LS08003506	MW-3	45137	5801
LS08003508	MW-5	45137	5801
LS08003509	MW-6	45137	5801
LS08003511	MW-8	45137	5801

Analysis Method: SW-846 6010D

Lab #	Client ID #	Analysis Batch #	Prep Batch #
LS08003512	MW-1m	45066	5795
LS08003513	MW-2m	45066	5795
LS08003514	MW-3m	45066	5795
LS08003515	MW-4m	45066	5795
LS08003516	MW-5m	45066	5795
LS08003517	MW-6m	45066	5795
LS08003518	MW-7m	45085	5797

Analysis Method: SW-846 7010

Lab #	Client ID #	Analysis Batch #	Prep Batch #
LS08003512	MW-1m	45051	5795
LS08003513	MW-2m	45051	5795

Surrogate Non-Conformance Continued

Surrogates

QC Number	Test Name	Batch #	Blank Result	% Rec	RPD	Low Limit	High Limit	Analysis Date	Prep Batch #	Method
LS08003504R	n-Pentacosane	45137		153*		50 -	150%	4/27/2022		ETPH
LS08003505R	n-Pentacosane	45137		117.2		50 -	150%	4/27/2022		ETPH
LS08003506R	n-Pentacosane	45137		107.6		50 -	150%	4/27/2022		ETPH
LS08003508R	n-Pentacosane	45137		117.8		50 -	150%	4/27/2022		ETPH
LS08003509R	n-Pentacosane	45137		137.2		50 -	150%	4/27/2022		ETPH
LS08003511R	n-Pentacosane	45137		119.4		50 -	150%	4/27/2022		ETPH

- **Change of pace!** Surrogates are **sample**-specific
  - Only reflect on the sample specified in the narrative, not the entire batch

DQA Worksheet

Sample #	Lab ID	Location ID	Parameter	Non-conformance	%R or Blank Conc	Bias	Sample Result	Clean-up Criteria	Comments
MW-7m	LS08003518	MW-7m	Cadmium	LCS	57.47	Low	0.005 mg/L	GWPC = 0.005 mg/L	LCS not reanalyzed by laboratory
MW-7m	LS08003518	MW-7m	Copper	LCS	60.93	Low	0.047 mg/L	GWPC = 1.3 mg/L	LCS not reanalyzed by laboratory
MW-1	LS08003504	MW-1	n-Pentacosane	Surrogate	153	High	**270 µg/L**	GWPC = 250 µg/L	

Reviewing Laboratory Analytical Data

- Check reporting limits (RLs)
  - **Scan the RL column in the lab report**
    - Are they less than clean-up criteria and/or less than noted RL on Chain of Custody?
- Were there any detections reported above the RLs?
- Check dilution factor (Dil) column to see if dilution performed
  - **Dilutions increase the RLs**
  - **If a dilution increases the RL > criteria data may be unusable**
  - **May want to ask lab if there was a matrix issue**

Analysis Method: SW-846 8260D

	Test	Result	Units	Dil	RL
LS08003506	Acetone	ND	µg/L	1	10.0
LS08003506	Acrylonitrile	ND	µg/L	1	0.5
LS08003506	Benzene	ND	µg/L	1	0.5
LS08003506	Bromobenzene	ND	µg/L	1	0.5
LS08003506	n-Butylbenzene	ND	µg/L	1	0.5
LS08003506	sec-Butylbenzene	ND	µg/L	1	0.5
LS08003506	tert-Butylbenzene	ND	µg/L	1	0.5
LS08003506	Bromodichloromethane	ND	µg/L	1	0.5
LS08003506	Bromoform	ND	µg/L	1	0.5
LS08003506	Bromomethane	ND	µg/L	1	0.5
LS08003506	Methyl ethyl ketone	ND	µg/L	1	2.0
LS08003506	Carbon disulfide	ND	µg/L	1	0.5
LS08003506	Carbon Tetrachloride	ND	µg/L	1	0.5
LS08003506	Chlorobenzene	ND	µg/L	1	0.5
LS08003506	Chloroethane	ND	µg/L	1	0.5
LS08003506	Chloroform	ND	µg/L	1	0.5
LS08003506	Chloromethane	ND	µg/L	1	0.5
LS08003506	1,2-Chlorotoluene	ND	µg/L	1	0.5
LS08003506	1,4-Chlorotoluene	ND	µg/L	1	0.5
LS08003506	Dibromochloromethane	ND	µg/L	1	0.5
LS08003506	1,2-Dibromo-3-chloropropane (DBCP)	ND	µg/L	1	0.5
LS08003506	Ethylene Dibromide (EDB)	ND	µg/L	1	0.5
LS08003506	Dibromomethane	ND	µg/L	1	0.5
LS08003506	1,2-Dichlorobenzene	ND	µg/L	1	0.5
LS08003506	1,3-Dichlorobenzene	ND	µg/L	1	0.5
LS08003506	1,4-Dichlorobenzene	ND	µg/L	1	0.5
LS08003506	trans-1,4-Dichloro-2-butene	ND	µg/L	1	0.5
LS08003506	Dichlorodifluoromethane	ND	µg/L	1	0.5
LS08003506	1,1-Dichloroethane	ND	µg/L	1	0.5

Pages 8 through 30

Analytical Qualifiers

- Qualifiers are indicated with letters/symbols next to a sample result
  - **e.g., “B”, “*”, “J”, etc.**
  - **NOTE! Only report concentrations >RL, “J” flags shouldn’t be reported to DEEP, unless reporting TICs**
  - **“B” flags are used for qualifying results with contamination in blank**

Analysis Method: SW-846 6010D **Prep By:** js **Prep Date:** 4/21/2022
Prep Batch: 5795

	Test	Result	Units	Dil	RL	Analyst	Analysis Date	Batch #
LS08003515	Cadmium	ND	mg/L	1	0.002	JM	4/23/2022	45066
LS08003515	Lead	ND	mg/L	1	0.010	JM	4/23/2022	45066
LS08003515	Barium	0.020	mg/L	1	0.010	JM	4/23/2022	45066
LS08003515	Selenium	ND	mg/L	1	0.010	JM	4/23/2022	45066
LS08003515	Chromium, Total	ND	mg/L	1	0.005	JM	4/23/2022	45066
LS08003515	Copper	0.007	mg/L	1	0.005	JM	4/23/2022	45066
LS08003515	Nickel	0.0037	mg/L	1	0.010	JM	4/23/2022	45066
LS08003515	Silver	ND	mg/L	1	0.005	JM	4/23/2022	45066
LS08003515	Zinc	0.029 B	mg/L	1	0.010	JM	4/23/2022	45066

Review Sample Results

- Check analytes reported for each sample
  - **Do they match the analytes requested on the Chain of Custody?**
    - Partial list of RCP metals was requested on Chain of Custody, i.e., RCRA 8, Cu, Ni, and Zn
    - 8260 requested
    - We've already noted that MW-4 & -7 were not analyzed for ETPH as requested
- Analytes requested on Chain of Custody cover the identified Constituents of Concern
  - **Scenario, page 2 of 54**
- RLs reported ≤ GWPC

Reviewing the Laboratory QC Report

Pages 31 through 43

- Includes data for…
  - **Method blanks**
  - **Field blanks**
  - **Laboratory Control Samples**
  - **Surrogates**
  - **Matrix spikes**
  - **Spike & Lab duplicates**
  - **etc.**
- Check any samples marked with “MS/MSD” on Chain of Custody have results in this section of the report

Final DQA Worksheet

- Page 49 of 54

Lab ID #	Location ID#	Parameter	Non-Conformance	%Recovery or Method Blank Contamination	Relative Percent Difference	Bias	Results	Clean-up Criteria (GWPC)	Comments
LS08003504	MW-1	ETPH	Surrogate: n-Pentacosane	153		high	290 µg/L	250 µg/L	
		1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
LS08003505	MW-2	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
LS08003506	MW-3	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
LS08003507	MW-4	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
		ETPH	No result reported						
LS08003508	MW-5	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
LS08003509	MW-6	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
LS08003510	MW-7	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
		ETPH	No result reported						
LS08003511	MW-8	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound
		1,1-dichloroethylene	MS/MSD		34.85	non-directional	ND<0.5 µg/L	7 µg/L	
		2-hexanone	MS/MSD		54.6	non-directional	ND<1.0 µg/L	35 µg/L	RCP poorly performing compound
		Acetone	MS/MSD		35.73	non-directional	ND<10.0 µg/L	700 µg/L	RCP poorly performing compound
		Acrylonitrile	MS/MSD		41.92	non-directional	ND<0.5 µg/L	0.5 µg/L	
		cis-1,2-dichloroethylene	MS/MSD	131.51 / 134.15		high	ND<0.5 µg/L	70 µg/L	
		Dichlorodifluoromethane	MS/MSD		24.95	non-directional	ND<0.5 µg/L	350 µg/L	RCP poorly performing compound
		Tetrachloroethylene	MS/MSD	68.49 / 69.06		low	ND<0.5 µg/L	5 µg/L	
		Toluene	MS/MSD		21.64	non-directional	ND<0.5 µg/L	1,000 µg/L	
		Trans-1,2-dichloroethylene	MS/MSD		21.58	non-directional	ND<0.5 µg/L	100 µg/L	
		Trichloroethylene	MS/MSD	62.08 / 62.45		low	ND<0.5 µg/L	5 µg/L	

Final DQA Worksheet

Lab ID #	Location ID#	Parameter	Non-Conformance	%Recovery or Method Blank Contamination	Relative Percent Difference	Bias	Results	Clean-up Criteria (GWPC)	Comments
LS08003512	MW-1m	Zinc	Method Blank Contamination	0.01 mg/l detected in blank			ND<0.010 mg/L	5 mg/L	Common laboratory contaminant
LS08003513	MW-2m	Zinc	Method Blank Contamination	0.01 mg/l detected in blank			ND<0.010 mg/L	5 mg/L	Common laboratory contaminant
		Cadmium	MS/MSD	56.47 / 50.91		low	0.004 mg/L	0.005 mg/L	
LS08003514	MW-3m	Zinc	Method Blank Contamination	0.01 mg/l detected in blank			ND<0.010 mg/L	5 mg/L	Common laboratory contaminant
LS08003515	MW-4m	Zinc	Method Blank Contamination	0.01 mg/l detected in blank			0.029 mg/L	5 mg/L	Common laboratory contaminant
LS08003516	MW-5m	Zinc	Method Blank Contamination	0.01 mg/l detected in blank			ND<0.010 mg/L	5 mg/L	Common laboratory contaminant
LS08003517	MW-6m	Zinc	Method Blank Contamination	0.01 mg/l detected in blank			0.18 mg/L	5 mg/L	Common laboratory contaminant
LS08003518	MW-7m	Cadmium	LCS	57.47		low	0.005 mg/L	0.005 mg/L	LCS not reanalyzed by laboratory
		Copper	LCS	60.93		low	0.047 mg/L	1.3 mg/L	LCS not reanalyzed by laboratory

Step 2: DUE

Determining Data Usability

Beginning the DUE Process

Tools to Help

DQA Worksheet &/or summary tables

DUE worksheets

DUE Worksheet

Page 1 - *briefly* summarize DQA non-conformances

Page 2 - Attach a summary statement explaining how non-conformances affect usability on the specific project

Case Study 1 – Summary of Detected Results and QAQC Deficiencies

Constituent Detected	RSR GWPC	Samples MW-1 MW-1m	MW-2 MW-2m	MW-3 MW-3m	MW-4 MW-4m	MW-5 MW-5m	MW-6 MW-6m	MW-7 MW-7m	MW-8
ETPH	250 µg/L	290 µg/L [4]			No result			No result	
cis-1,2-Dichloroethylene	70 µg/L	88 µg/L [5]	66 µg/L [5]	76 µg/L [5]			61 µg/L [5]		
Tricholoethylene	5 µg/L	4.4 µg/L [1]	1.5 µg/L [1]	4.0 µg/L [1]			2.6 µg/L [1]		
Toluene	1,000 µg/L				0.6 µg/L				
Barium	1 mg/L	0.011 mg/L	0.023 mg/L	0.017 mg/L	0.020 mg/L	0.011 mg/L	0.037 mg/L		
Cadmium	0.005 mg/L		0.004 mg/L [1]				0.004 mg/L [1]	0.005 mg/L [1,3]	
Nickel	0.1 mg/L				0.037 mg/L				
Zinc	5 mg/L				0.029 mg/L [2]		0.18 mg/L [2]		
Copper	1.3 mg/L						0.045 mg/L	0.047 mg/L [3]	

QAQC Deficiency:
[1] Low bias for MS/MSD
[2] Method Blank contamination
[3] LCS low bias
[4] Surrogate high bias
[5] MS/MSD high bias
Potential usability issues highlighted in red

DQA Summary Table

- Another example of how to further condense the information collected during the DQA
- Use for comparing samples with reported detections against parameters with deficiencies noted
- **Page 50 of 54**

Combining DQA and DUE Information

- Case Study 1 DQA Worksheet
  - **Page 49 of 54**
- Can add more columns to worksheet with DUE considerations to help compare all information in one location

Lab ID #	Location ID#	Parameter	Non-Conformance	%Recovery or Method Blank Contamination	Relative Percent Difference	Bias	Results	Clean-up Criteria (GWPC)	Comments	DUE Considerations
LS08003504	MW-1	ETPH	Surrogate: n-Pentacosane	153		high	290 µg/L	250 µg/L		Result exceeds GWPC, usability depends upon subsequent results
		1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound	Low bias, RL at GWPC - possibly usable depending on subsequent sampling
LS08003505	MW-2	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound	Low bias, RL at GWPC - possibly usable depending on subsequent sampling
LS08003506	MW-3	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound	Low bias, RL at GWPC - possibly usable depending on subsequent sampling
LS08003507	MW-4	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound	Low bias, RL at GWPC - possibly usable depending on subsequent sampling
		ETPH	No result reported							ETPH analysis not performed
LS08003508	MW-5	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound	Low bias, RL at GWPC - possibly usable depending on subsequent sampling
LS08003509	MW-6	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound	Low bias, RL at GWPC - possibly usable depending on subsequent sampling
LS08003510	MW-7	1,1,2,2-tetrachloroethane	LCS	60		low	ND<0.5 µg/L	0.5 µg/L	RCP poorly performing compound	Low bias, RL at GWPC - possibly usable depending on subsequent sampling
		ETPH	No result reported							ETPH analysis not performed

DUE Worksheet: DQA Non-Conformance Summary

APPENDIX I-2
DATA USABILITY EVALUATION WORKSHEET

Project Name: KRRG Plating
Laboratory: JGBT
Sample Delivery Group:
Sample Delivery Group Number:
Date Samples Collected: 4/17/2022
Reviewer: Geordi La Forge

Describe the intended use of the data: First round of groundwater monitoring to determine if remediation was effective and to evaluate compliance with GA Ground Water Protection Criteria.

Nonconformance DQA Review Elements	Briefly Summarize DQA Nonconformances
Laboratory Report Inspection	
Reasonable Confidence Evaluation	
Chain of Custody Evaluation	
Sample Result Evaluation	
Sample Preservation and Holding Time Evaluation	
Blank Evaluation	
Laboratory Control Samples and Laboratory Control Sample Duplicates	
Surrogates	
Site Specific Matrix Spikes and Matrix Spike Duplicates	
Tentatively Identified Compounds	
Other QC data	

DUE Worksheet: DQA Non-Conformance Summary

APPENDIX I-2 (CONTINUED)
DATA USABILITY EVALUATION WORKSHEET

Provide a summary statement describing how the analytical data set relied upon is of adequate quality and of sufficient accuracy, precision, and sensitivity for the intended purpose. Questions for the EP to consider during the DUE include, but are not limited to, the following, please see the text of this guidance for additional information:

How will the analytical data be used:

- Will the analytical results be used to determine compliance with RSR criteria?
- Will be analytical results be used to determine a release has occurred?
- Will remediation be conducted?
- Has remediation been conducted?
- Are the results going to be used to guide further investigation?
- Are the results going to be used to guide further remediation (including monitored natural attention of groundwater)?
- Evaluate seasonal variability, or homogeneity in an environmental sample?

Laboratory QC Information

- Are significant QC variances reported?
- Are the identified QC nonconformances related to results for substances that are reported as "ND," and the reporting limits are significantly less than RSR criteria?
- Are the nonconformances related to poorly performing compounds that are not constituents of concern?
- Are the nonconformances related substances that are not constituents of concern?
- Is the reported bias high or low? For cases with low bias, are the results well below applicable RSR criteria or are they close to applicable RSR criteria?
- How do the nonconformances effect "NDs" and reported concentrations?

DQOs

- Were the DQOs precision, accuracy, representativeness, comparability, completeness and sensitivity met?
- Are all critical samples usable for the intended purpose(s)?
- Does sample homogeneity or heterogeneity effect the representativeness of the samples?

CSM

- Do any analytical QC nonconformances create significant data gaps in the Conceptual Site Model?
- Evaluate the entire body of information (type, amount, and quality data) available for the specific area/release for which the data are presumed to be representative. Determine whether any newer data corroborate the older results and whether both sets of data are consistent with the CSM.
- Consider the risk of being wrong based on risk to potential receptors and the risk to human health and the environment.
- Consider the source of data (e.g., whether the data were generated by the EP's own firm or some other firm, the EP's own involvement with the project, method of collection for the samples, and reporting methods by other firms/laboratories generating the data). Perform a critical review of these data to evaluate its reliability.
- Consider any other site-specific factors.

PRE RCP DATA - See section 4.5 of this guidance document for information to consider.

- How will the data be used?
  - Compliance monitoring
    - ❑ Did excavation activities successfully remediate release to groundwater?
    - ❑ Do groundwater concentrations >GWPC?
    - ❑ Are detections indicative more remediation is necessary?
- Laboratory QC information
- Data quality objectives
- Conceptual site model
- Multiple lines of evidence

Determining Usability of VOC Data

1,1,2,2-tetrachloroethane in LCS indicates **low bias**

- Applies to all project samples in the same batch
- Reported sample results for 1,1,2,2-tetrachloroethane were “ND”
- RL = GWPC
- **Conclusion: actual concentrations may not be “ND” and may be > GWPC**

TCE in MS/MSD indicates **low bias** in sample MW-8

- Applies to all project samples
- MW-1, -3, & -6 had reportable concentrations close to GWPC
- **Conclusion: actual concentrations could be >GWPC**

Additional sampling will be conducted during compliance monitoring which will further evaluate these issues

Determining Usability of Metals Data

Cadmium in MS/MSD indicates **low bias** in sample MW-2m

- Applies to all project samples
- MW-2m, -6m, & -7m had reportable concentrations close to GWPC
- **Conclusion: actual concentrations could be >GWPC**

Cadmium & Copper in LCS indicates **low bias**

- Applies to all project samples in the same batch
- MW-7m was the only project sample in the batch
- MW-7m had a reportable concentration close to GWPC
- **Conclusion: actual concentration could be >GWPC**

Zinc found in method blank

- Applies to samples analyzed in the same batch
- "ND" in most samples
- Reported in 2 samples, but <<GWPC
- 1 sample-Zinc in sample was <10x the blank concentration
  - **Conclusion: detection likely result of blank contamination**
- 1 sample-Zinc in sample was >10x the blank concentration
  - **Conclusion: confirmed detection in sample**
- Contact the lab prior to next sampling event to attempt to resolve issue for next time

Additional sampling will be conducted during compliance monitoring which will further evaluate these issues

Determining Usability of ETPH Data

Surrogate in one sample indicated **high bias**

- ETPH concentration in sample >GWPC
- **Conclusion: bias has no effect on usability**

Results missing for MW-4 & MW-7

- Samples broken during transit
- **Conclusion: Compliance monitoring will begin at next sampling event**

Determining Usability for Other Non-Conformances

Non-conformances indicating **low bias** noted for other constituents

- Reported sample concentrations << GWPC
- **Conclusion: no effect on usability**

Example of DQA & DUE Text for the Report

Case Study #1

Example DQA and DUE Text for the Report

Summarizes purpose of sample collection and general DQA results

Page 53-54

Groundwater samples collected from 7 wells at KRRG Plating were submitted to a state-certified analytical laboratory for analysis using Reasonable Confidence Protocols (RCPs) to evaluate whether remediation of a release of process waste from an in-ground wastewater treatment sump was effective and whether compliance with the Ground Water Protection Criteria (GWPC) could be demonstrated once four quarterly rounds of groundwater samples had been collected. This sampling event represented the first round of groundwater monitoring. A data quality assessment (DQA) and data usability evaluation (DUE) were performed in accordance with guidance published the Department of Energy and Environmental Protection (DEEP).

Results of the DQA indicated that, in general, the analytical data are of adequate quality for the intended purpose. However, ETPH samples from wells MW-4 and MW-7 were not analyzed, as the containers were broken in transit to the laboratory; subsequent sampling is necessary at these wells to begin monitoring for ETPH. QA/QC issues are summarized in the DQA worksheet included in Appendix X of this report. The primary QA/QC issues identified during the DQA are summarized below.

Example of DQA & DUE Text for the Report

Non-conformances identified and summarized

Page 53-54

- Zinc was detected in the method blank (0.01 mg/L). Zinc was detected in MW-4 and MW-6, the remaining samples were ND. Per the EPA National Functional Guidelines for Inorganic Superfund Methods Data Review, the reported sample concentrations are compared to 10x the blank concentration to assess if the samples are truly detected or possibly biased by the blank concentration. The reported zinc concentration in MW-4 (0.029 mg/L) was less than 10 times the reported blank concentration. Therefore, it is likely the detection in MW-4 is biased high. However, the reported concentration in MW-6 (0.18 mg/L) was greater than 10 times the reported blank concentration. Therefore, the reported concentration is a confirmed detection in MW-6. Additional sampling will be conducted during compliance monitoring which will further evaluate these issues.
- Analytical results for Matrix Spikes and Matrix Spike Duplicates (MS/MSDs) indicate a potential low bias for cadmium in the results for groundwater samples. The reported analytical results for cadmium are close to the GWPC for groundwater from wells MW-2, MW-6, and MW-7. Therefore, the reported concentrations for cadmium may actually be greater than the GWPC.
- The result for the surrogate compound for ETPH indicates a potential high bias for sample MW-1. Reported concentrations for ETPH are above the GWPC for that sample therefore there is no effect on the usability of the data.
- The LCS for 1,1,2,2-tetrachloroethane indicates low bias, which affects all samples. This compound was not detected in any of the samples, but the reporting limit is at the GWPC. Therefore, concentrations of 1,1,2,2-tetrachloroethane may actually be greater than the GWPC.
- Results for the MS/MSD indicate a potential low bias for TCE, which affects all samples. At locations MW-1, MW-3, and MW-6, TCE was detected at concentrations close to the GWPC. Therefore, the reported concentrations for TCE may actually be greater than RSR criteria at these locations.
- Additional QA/QC nonconformances indicating a potential low bias were noted for constituents that were reported at concentrations well below the GWPC.

Example of DQA & DUE Text for the Report

Connects the results of the DQA and DUE with respect to the usability of the data

Page 53-54

Results of the DQA and preliminary DUE indicated that of the issues identified above, only the issues related to cadmium, TCE and 1,1,2,2-tetrachloroethane had the potential to affect the usability of the data. A full DUE was performed using the results of the DQA in conjunction with the analytical results for the groundwater samples, the comparison of those results to applicable regulatory criteria, the entire data set for the sampling event, the conceptual site model, and the purpose of the groundwater sampling event (first round of sampling).

The DUE indicated that analytical results could be used to conclude that cadmium, TCE, and 1,1,2,2-tetrachlorethane were present in groundwater at the identified locations despite a potential low bias associated with the results for those compounds. Results for both cadmium and TCE were close to the respective GWPC at specific locations, and reported results could be greater than the respective GWPC. Results for 1,1,2,2-tetrachloroethane indicated no detection above the reporting limit, which was at the GWPC, and therefore actual concentrations could exceed the GWPC. Usability of the results for these three constituents for determining compliance with the GWPC can only be effectively evaluated after additional sampling rounds have been conducted. If subsequent results are consistent with, or lower than, the concentrations detected during this sampling round, and a potential low bias is not identified for those constituents at the same locations during subsequent sampling events, the data from this first event could likely be used to demonstrate compliance with the GWPC, despite the potential low bias identified during this sampling event. However, such a determination would require review of the entire data set of four quarterly sampling events in conjunction with the conceptual site model to support that conclusion.


Now for Case Study 2…

CASE STUDY #2

Presented by:

Kevin Vanderveer
DEEP | Remediation Division

Case Study #2 Objectives

Build on the approach and on concepts presented in Case Study #1

- Focus is on the DUE
- Review the DQA
- Complete the DUE
- Document the DUE

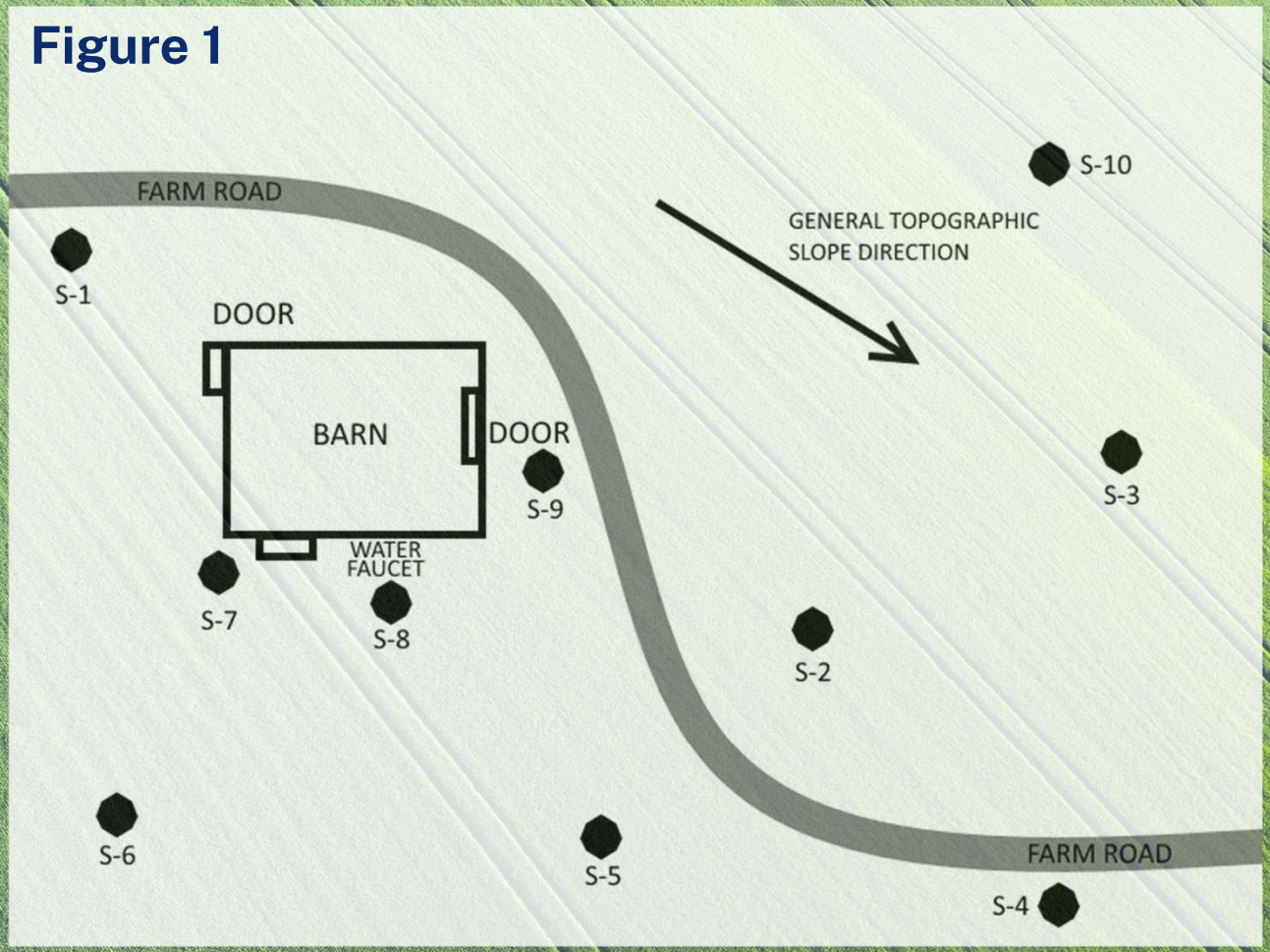
Case Study #2 Scenario

- Former agricultural land
  - Pesticide mixing and storage in the barn area
- Proposed mixed-use development – Residential, commercial, and recreational
- Rush project – Developer must decide ASAP whether the project is viable based on potential remediation costs should pesticides be present at concentrations that pose a risk under the proposed development scenario.
  - Has there been a release of pesticides?
  - Are pesticides the result of application?
  - Are the concentrations of pesticides greater than RDEC ?
    - *For purposes of this case study, analytical results will be compared to RDEC only*

Sample Collection

- Ten shallow soil samples were collected.
- All samples were the same soil type.
- Soil samples were analyzed by RCP Method 8081 for pesticides.
- Samples were collected and delivered to the laboratory on the same day on ice.

Figure 1


FARM ROAD
S-1
DOOR
BARN
DOOR
S-9
WATER
FAUCET
S-7
S-8
S-10
GENERAL TOPOGRAPHIC
SLOPE DIRECTION
S-3
S-2
S-6
S-5
FARM ROAD
S-4

Data Quality Decision

The laboratory called the project manager:

- The Endrin/DDT standard indicated significant breakdown at the injection port
- Significant RCP nonconformance

The client needed results right away:

- Project manager instructed the laboratory to report the results as is with the Endrin/DDT standard breakdown nonconformances.

DUE STEP 1: CONDUCT DQA

Case Study #2

With big data comes big responsibilities.
~Kate Crawford

Data Quality Assessment – General Considerations

Summarize data quality issues (non-conformances)

Reminders:

- Narratives are critical sources of information
  - Identify nonconformances not required to be included in the QC data portion of the laboratory analytical report
- Surrogates, Spikes, Blanks → Accuracy
- Duplicates → Precision
- Reporting Limits → Sensitivity

Review of DQA Information

LABORATORY CERTIFICATION FORM

1	For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEEP method-specific Reasonable Confidence Protocol documents?	☐Yes ☒No
1A	Were the method-specified preservation and holding time requirements met?	☒Yes ☐No
1B	***VPH and EPH Methods only***: Was the VPH or EPH method conducted without significant modifications (see respective RCPs)	☐Yes ☐No ☒N/A
2	Were all samples received by the laboratory in a condition consistent with that described on the associated chain-of-custody document(s)?	☒Yes ☐No
3	Were samples received at an appropriate temperature (≤6° C)? *If samples were received by the laboratory on the same day of collection and were stored and transported to the laboratory on ice, cooler temperatures above 6°C are acceptable.*	☐Yes ☒No ☐N/A
4	Were all QA/QC performance criteria specified in the CT DEEP Reasonable Confidence Protocol documents achieved?	☐Yes ☒No
5	Were reporting limits / limits of quantitation specified or referenced on the chain-of-custody?	☒Yes ☐No
5A	Were these reporting limits / limits of quantitation met?	☐Yes ☒No
6	For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the Reasonable Confidence Protocol documents?	☒Yes ☐No
7	Are project-specific matrix spikes and laboratory duplicates included in this data set for applicable RCPs?	☒Yes ☐No

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A, or #1B is "No", the data package does not meet the requirements for "Reasonable Confidence." This form may not be altered, and all questions must be answered.

Laboratory Narrative (p. 1)

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report.

Please see the associated electronic data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

The samples were received in accordance with the chain of custody and no significant deviations were encountered during preparation or analysis unless otherwise noted below.

Sample Receipt

In reference to question 3: The submitted samples were not received at the appropriate temperature of four degrees Celsius (+ or - 2 degrees Celsius). The samples were received at 9 degrees Celsius, but were delivered on ice directly from the site.

LABORATORY NARRATIVE (P. 2)

Pesticides

In reference to question 1:

The associated Degradation Standards were evaluated for 4,4'-DDT and Endrin breakdown products. The standards were determined to be above the acceptance criteria for Endrin @ 50%; however, the standard was within criteria for 4,4'-DDT @ 10%. The client was contacted and approved proceeding with the analysis.

In reference to question 4:

The surrogate recoveries for samples AL1234-1 through -6 and -10 were below the method acceptance criteria for Decachlorobiphenyl; however, re-extraction could not be performed due to lack of additional sample. The results of the original analysis are reported; however, all associated compounds are considered to have a potentially low bias.

The surrogate recoveries for samples AL1234-7 through -9 are below the method acceptance criteria for Decachlorobiphenyl and TCMX due to the dilutions required to quantitate the samples. Re-extraction is not required; therefore, the results of the original analysis are reported.

The WO888-2/-3 LCS/LCSD recoveries associated with samples AL1234-1 through -10 were below the method acceptance criteria for endrin (35%/38%); however, re-extraction could not be performed due to lack of additional sample. The results of the original analyses are reported; however, all results are considered to have a potentially low bias for this compound.

The WO888-4/-5 MS/MSD recoveries associated with samples AL1234-1 through -10 were below the method acceptance criteria for endrin (28%/29%); however, re-extraction could not be performed due to lack of additional sample. The results of the original analyses are reported; however, all results are considered to have a potentially low bias for this compound.

The WO888-4/-5 MS/MSD RPD associated with samples AL1234-1 through -10 is above the method acceptance criteria for 4,4'-DDT. The results of the associated samples are reported.

In reference to question 5b:

AL1234-7 through -9 were analyzed on a 20x dilution due to the elevated concentration of target compounds in the samples, therefore the reporting limits for several compounds exceed the Residential Direct Exposure Criteria.

DQA Worksheet (p. 1)

Laboratory: Acme
SDG:
Date Samples Collected: 8/12/2022
RCP Cert Form Included: Yes
Lab Case Narrative Included: Yes

Note 1: Bias High: reported result may be lower. RL is acceptable as reported.
Bias Low: reported result may be higher. RL may be higher than reported.
Note 2: Matrix Spike S-1; associated samples S-1 through S-10
Note 3: Samples delivered directly from the site and on ice. Evidence of cooling. No impact to usability.

Sample ID	COMPOUND	QC OUTLIER	%R Col A/B	RPD	BIAS	RESULTS (mg/kg)	RSR RDEC (mg/kg)	COMMENTS	PRELIMINARY DUE CONSIDERATIONS/NOTES
SAMPLE S-1									
S-1	All Pesticides	Surrogate: Decachlorobiphenyl COL A/B	26/20		low			Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
S-1	All Pesticides	MS Surr: Decachlorobiphenyl COL A/B	24/19		low			MS/MSD Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
S-1	All Pesticides	MSD Surr: Decachlorobiphenyl COL A/B	25/20		low			MS/MSD Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
S-1	Endrin	LCS/LCSD - Endrin	35/38		low	ND< 0.0037	20[1]	LCS/LCSD - Endrin low bias	Low bias endrin
S-1	Endrin	MS/MSD - Endrin	28/29		low			MS/MSD Endrin low bias	Low bias endrin
S-1	Endrin	Endrin Std breakdown 50%			low			Endrin Breakdown Check Std > 15% low bias Endrin	Significant RCP QC variance reject Endrin NDs as NDs
S-1	4,4'-DDT	MS/MSD - 4,4'-DDT		41	non-directional	ND< 0.0037	1.8 [1]	4,4'-DDT - high RPD MS/MSD	RL<< critieria, no impact to usability
SAMPLE S-2									
S-2	All Pesticides	Surrogate: Decachlorobiphenyl COL A/B	24/19		low			Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
MS	All Pesticides	MS Surr: Decachlorobiphenyl COL A/B	24/19		low			MS/MSD Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
MSD	All Pesticides	MSD Surr: Decachlorobiphenyl COL A/B	25/20		low			MS/MSD Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
S-2	Endrin	LCS/LCSD - Endrin	35/38		low	0.038	20[1]	LCS/LCSD - Endrin low bias	Low bias endrin
MS/MSD	Endrin	MS/MSD - Endrin	28/29		low			MS/MSD Endrin low bias	Low bias endrin
S-2	Endrin	Endrin Std breakdown 50%			low			Endrin Breakdown Check Std > 15% low bias Endrin	Endrin << RDEC no impact to usability
S-2	Endrin aldehyde	Endrin Breakdown Products			possible high	0.015	20[1]	Endrin Breakdown Products	Endrin breakdown product from lab or from on-site? - not known.
S-2	Endrin ketone	Endrin Breakdown Products			possible high	0.012	20[1]	Endrin Breakdown Products	Endrin breakdown product from lab or from on-site? - not known.
S-2	Dieldrin	Surrogate: Decachlorobiphenyl COL A/B	24/19		low	0.0312	0.038	Results close to criteria, surrogate low bias	MS and MSD % R within acceptable criteria. No impact to usability.
MS/MSD	4,4'-DDT	MS/MSD - 4,4'-DDT		41	non-directional	1.78	1.8 [1]	Results close to criteria, non-directional bias	Results may be greater than criteria due to high RPD.
SAMPLE S-3									
S-3	All Pesticides	Surrogate: Decachlorobiphenyl COL A/B	21/17		low			Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
MS	All Pesticides	MS Surr: Decachlorobiphenyl COL A/B	24/19		low			MS/MSD Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
MSD	All Pesticides	MSD Surr: Decachlorobiphenyl COL A/B	25/20		low			MS/MSD Surrogate %R low for all samples	Except for Endrin, all MS/MSD analytes within acceptance criteria
S-3	Endrin	LCS/LCSD - Endrin	35/38		low	0.018	20[1]	LCS/LCSD - Endrin low bias	Low bias endrin
MS/MSD	Endrin	MS/MSD - Endrin	28/29		low			MS/MSD Endrin low bias	Low bias endrin
S-3	Endrin	Endrin Std breakdown 50%			low			Endrin Breakdown Check Std > 15% low bias Endrin	Endrin << RDEC, no impact to usability
S-3	Dieldrin	Surrogate: Decachlorobiphenyl COL A/B	21/17		low	0.0102	0.038	Surrogate low bias	MS and MSD % R within acceptable criteria. No impact to usability
MS/MSD	4,4'-DDT	MS/MSD - 4,4'-DDT		41	non-directional	0.345	1.8 [1]	Non-directional bias	MS/MSD % recovery within acceptable criteria, results << RDEC
S-3	Endrin aldehyde	Endrin Breakdown Products			possible high	0.007	20[1]	Endrin Breakdown Products	Endrin breakdown product from lab or from on-site?
S-3	Endrin ketone	Endrin Breakdown Products			possible high	0.005	20[1]	Endrin Breakdown Products	Endrin breakdown product from lab or from on-site?

[1] APS Criteria

Key QA/QC Issues

- Endrin/DDT standard breakdown and breakdown products
- Surrogate recoveries
- Matrix spike (MS)/MS duplicate results
- Laboratory control samples (LCS)/LCS duplicates
- Elevated reporting limits

DUE STEP 2: EVALUATE DATA USABILITY

Case Study #2

You can have data without information, but you can't have information without data.

~Daniel Keys Moran

Primary Purpose of the DUE

- Determine whether the quality of the analytical data is suitable for the intended purpose.
- DUE can also identify whether data may be usable in specific, limited situations or for specific alternative purposes.

Data Usability Evaluation

Review issues identified in the DQA in relation to the intended use of the analytical data (or an alternative use).

Use different types of laboratory QC data, the CSM, and multiple lines of evidence to evaluate the effect of any identified biases.

Document the thought process used to reach the conclusions of the DQA and DUE.

DUE Worksheet: DQA Non-Conformance Summary

APPENDIX I-2
DATA USABILITY EVALUATION WORKSHEET

Project Name: Case Study #2, LEP Associates, BETA
Laboratory: ACME Laboratory
Sample Delivery Group:
Sample Delivery Group Number:
Date Samples Collected: 8/05/2022
Reviewer: William Riker

Describe the intended use of the data: Historical farm and associated agricultural practices. The proposed redevelopment includes residential and recreational activities. The developer needs to determine as soon as possible if conditions at the site will require sufficient remediation to affect the financial viability of the proposed development. The goal of the investigation is to quickly determine if the surficial soil has been impacted by long-time use of pesticides. The results will be compared to the default, numeric RDEC of the RSRs. Based on the findings, pollutant mobility may be evaluated after the initial investigation. The proposed redevelopment includes residential and recreational activities.

Nonconformance DQA Review Elements	Briefly Summarize DQA Nonconformances
Laboratory Report Inspection	
Reasonable Confidence Evaluation	
Chain of Custody Evaluation	
Sample Result Evaluation	
Sample Preservation and Holding Time Evaluation	
Blank Evaluation	
Laboratory Control Samples and Laboratory Control Sample Duplicates	
Surrogates	
Site Specific Matrix Spikes and Matrix Spike Duplicates	
Tentatively Identified Compounds	
Other QC data	

DUE Worksheet: Usability Statement Considerations

APPENDIX I-2 (CONTINUED)
DATA USABILITY EVALUATION WORKSHEET

Provide a summary statement describing how the analytical data set relied upon is of adequate quality and of sufficient accuracy, precision, and sensitivity for the intended purpose. Questions for the EP to consider during the DUE include, but are not limited to, the following, please see the text of this guidance for additional information:

How will the analytical data be used:

- Will the analytical results be used to determine compliance with RSR criteria?
- Will be analytical results be used to determine a release has occurred?
- Will remediation be conducted?
- Has remediation been conducted?
- Are the results going to be used to guide further investigation?
- Are the results going to be used to guide further remediation (including monitored natural attention of groundwater)?
- Evaluate seasonal variability, or homogeneity in an environmental sample?

Laboratory QC Information

- Are significant QC variances reported?
- Are the identified QC nonconformances related to results for substances that are reported as "ND," and the reporting limits are significantly less than RSR criteria?
- Are the nonconformances related to poorly performing compounds that are not constituents of concern?
- Are the nonconformances related substances that are not constituents of concern?
- Is the reported bias high or low? For cases with low bias, are the results well below applicable RSR criteria or are they close to applicable RSR criteria?
- How do the nonconformances effect "NDs" and reported concentrations?

DQOs

- Were the DQOs precision, accuracy, representativeness, comparability, completeness and sensitivity met?
- Are all critical samples usable for the intended purpose(s)?
- Does sample homogeneity or heterogeneity effect the representativeness of the samples?

CSM

- Do any analytical QC nonconformances create significant data gaps in the Conceptual Site Model?
- Evaluate the entire body of information (type, amount, and quality data) available for the specific area/release for which the data are presumed to be representative. Determine whether any newer data corroborate the older results and whether both sets of data are consistent with the CSM.
- Consider the risk of being wrong based on risk to potential receptors and the risk to human health and the environment.
- Consider the source of data (e.g., whether the data were generated by the EP's own firm or some other firm, the EP's own involvement with the project, method of collection for the samples, and reporting methods by other firms/laboratories generating the data). Perform a critical review of these data to evaluate its reliability.
- Consider any other site-specific factors.

PRE RCP DATA - See section 4.5 of this guidance document for information to consider.

- How will the data be used?
  - Rush project – Is redevelopment feasible
    - ❑ Was there a release of pesticides?
    - ❑ Do pesticides exceed the RDEC?
    - ❑ Where?
- Laboratory QC information
- Data quality objectives
- Conceptual site model
- Multiple lines of evidence

General DUE Questions to Consider

Data use – What is the risk of being wrong?

- Risk to potential receptors
- Financial liability
- Additional remediation/data needed after development

How does that risk of being wrong affect your approach to DUE?

- Overall approach should be conservative
- Lab narratives are a tool to identify potential interpretive risks
- DQOs can help frame potential risk
- Use the CSM and multiple lines of evidence to:
  - Answer critical questions
  - Strengthen conclusions

CSM Check-In

- Former agricultural field
- Pesticides were applied
- Mixing and storage of chemicals occurred in the vicinity of the barn
- All samples were collected as shallow soil samples
- All samples were the same matrix
- Redevelopment to include mixed residential/commercial use

DQA/DUE – Summary of Analytical Results

Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370	0.038	0.018	0.035	0.009	<0.003	17.8	19.8	18.7	<0.00337
Endrin Aldehyde		<0.00370	0.015	0.007	0.013	<0.00355	<0.00351	6.9	7.7	7.3	<0.00337
Endrin Ketone		<0.00370	0.012	0.005	0.011	<0.00355	<0.00351	5.3	5.9	5.6	<0.00337
Dieldrin	0.038	<0.00370	0.0312	0.0102	0.0117	0.0358	<0.00351	<0.0694	<0.0688	<0.0680	<0.00337
4,4-DDT	1.8 [1]	<0.00370	1.78	0.345	1.65	1.51	<0.00351	0.827	0.321	1.65	<0.00337
Aldrin	0.04 [1]	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694	<0.0688	<0.0680	<0.00337
Heptachlor epoxide	0.067	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694	<0.0688	<0.0680	<0.00337
Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694	<0.688	<0.680	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694	<0.688	<0.680	<0.0337

General Notes:

Units = mg/kg

S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

[20] - RDEC applies to the sum of all forms of Endrin

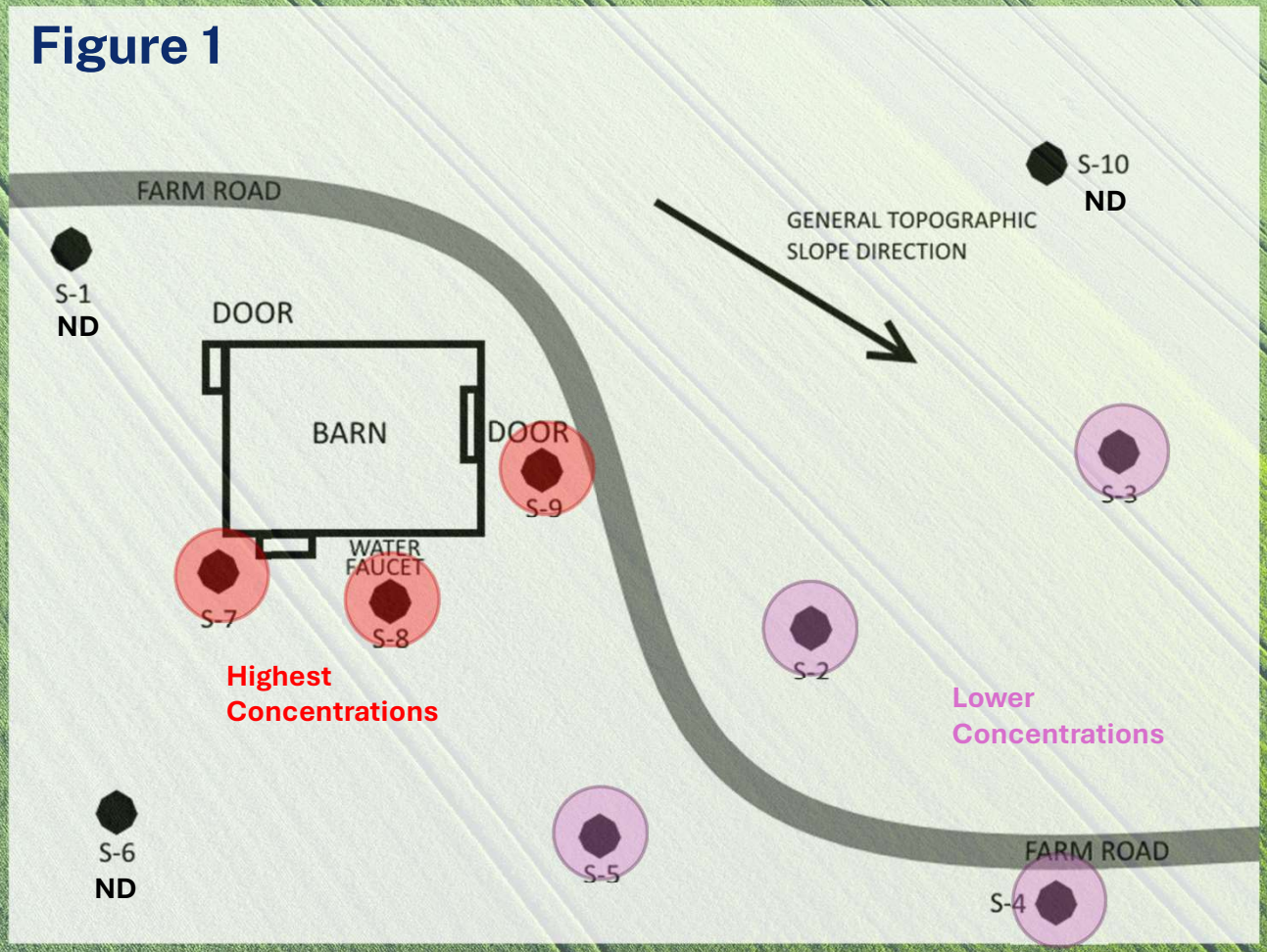
[1] Additional Polluting Substances Criteria

How Does the Data Shape the CSM?

- Q: Is the presence of pesticides detected in soil samples consistent with the CSM?
  - ➢ **Yes, detected results are consistent with the past use of pesticides at the site.**

- Q: Are these results consistent with the preliminary CSM?

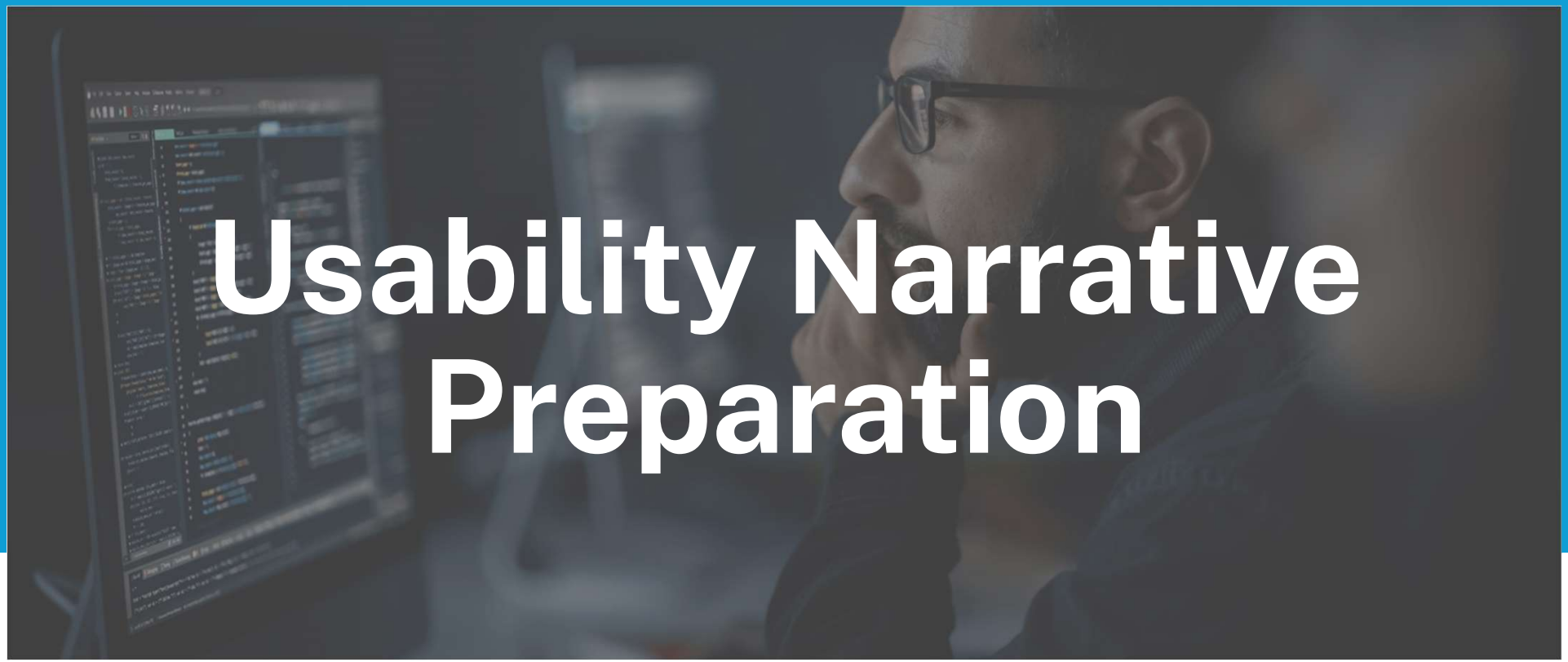
Figure 1


FARM ROAD
S-10
ND
GENERAL TOPOGRAPHIC
SLOPE DIRECTION
S-1
ND
DOOR
BARN
DOOR
S-9
S-3
WATER
FAUCET
S-7
S-8
S-2
Highest
Concentrations
Lower
Concentrations
S-6
ND
S-5
FARM ROAD
S-4

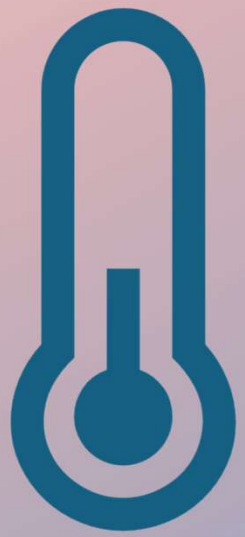
How Does the Data Shape the CSM?

- Q: Is the presence of pesticides detected in soil samples consistent with the CSM?
  - **Yes, detected results are consistent with the past use of pesticides at the site.**

- Q: Are these results consistent with the preliminary CSM?
  - **Concentrations of pesticides are greatest near the barn where storage and/or mixing of pesticides were reported to have occurred.**
  - **The "ND" results are at locations away from pesticide mixing and storage areas.**



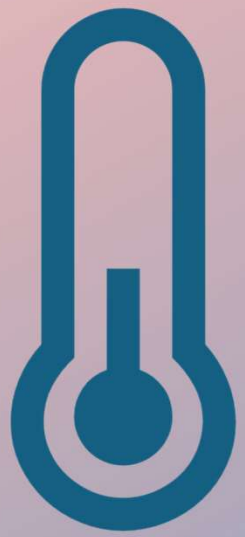
Usability Narrative Preparation



Temperature Narration

DQA Non-Conformances

- Samples delivered to laboratory at a temperature greater than 4 ^{0}C (± 2 ^{0}C).
- The temperature of samples on arrival at the laboratory was 9 ^{0}C.
- Samples were delivered on ice to the laboratory on the day of collection.



Temperature Narration *(cont.)*

Q: Were precision, accuracy, or sensitivity affected by this nonconformance

- No impact to precision, accuracy, or sensitivity, because the samples were delivered on ice on the day of collection.
- The cooling process had started, but the time between collection and delivery was too short to result in the samples being cooled to at least 6 ^{0}C.

DQA/DUE – Samples Affected by Non-Conformances

Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370 [1]	0.038 [2]	0.018 [2]	0.035 [2]	0.009 [2]	<0.003 [1]	17.8 [4]	19.8 [4]	18.7 [4]	<0.00337 [1]
Endrin Aldehyde		<0.00370	0.015 [3]	0.007 [3]	0.013 [3]	<0.00355	<0.00351	6.9 [3]	7.7 [3]	7.3 [3]	<0.00337
Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
Dieldrin	0.038	<0.00370	0.0312 [5]	0.0102 [5]	0.0117 [5]	0.0358 [5]	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
4,4-DDT	1.8 [10]	<0.00370 [8]	1.78 [6]	0.345 [7]	1.65 [6]	1.51 [6]	<0.00351 [8]	0.827 [6]	0.321 [7]	1.65 [6]	<0.00337 [8]
Aldrin	0.04 [10]	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Heptachlor epoxide	0.067	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

Units = mg/kg

S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

[20] - RDEC applies to the sum of all forms of Endrin

[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

[4] Endrin close to RDEC - surrogate low bias, diluted out. Endrin breakdown check standard > 15% extremely low bias.

[5] Dieldrin - Surrogate low bias. MS/MSD within acceptance critiera.

[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[7] DDT low level detects - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[8] DDT NDs - Surrogate low, but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

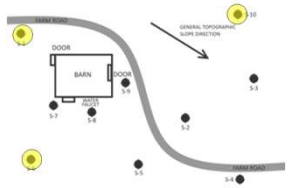
Endrin "NDs"

See yellow highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Low bias (QC lower than acceptance criteria)
  - Surrogate, LCS/LCSD and MS/MSD and MS/MSD surrogate.
- Endrin breakdown standard > 15%

DQA/DUE – Endrin NDs



Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370 [1]	0.038 [2]	0.018 [2]	0.035 [2]	0.009 [2]	<0.003 [1]	17.8 [4]	19.8 [4]	18.7 [4]	<0.00337 [1]
Endrin Aldehyde		<0.00370	0.015 [3]	0.007 [3]	0.013 [3]	<0.00355	<0.00351	6.9 [3]	7.7 [3]	7.3 [3]	<0.00337
Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
Dieldrin	0.038	<0.00370	0.0312 [5]	0.0102 [5]	0.0117 [5]	0.0358 [5]	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
4,4-DDT	1.8 [10]	<0.00370 [8]	1.78 [6]	0.345 [7]	1.65 [6]	1.51 [6]	<0.00351 [8]	0.827 [6]	0.321 [7]	1.65 [6]	<0.00337 [8]
Aldrin	0.04 [10]	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Heptachlor epoxide	0.067	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

Units = mg/kg

S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

[20] - RDEC applies to the sum of all forms of Endrin

[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

[4] Endrin close to RDEC - surrogate low bias, diluted out. Endrin breakdown check standard > 15% extremely low bias.

[5] Dieldrin - Surrogate low bias. MS/MSD within acceptance critiera.

[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[7] DDT low level detects - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[8] DDT NDs - Surrogate low, but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

Endrin "NDs" *(cont.)*

Q: Endrin was reported as "ND" in samples S-1, S-6, and S-10. Do the non-conformances associated with Endrin affect results that are "ND"?

- Yes.
- The "ND" results do not mean that Endrin is not present at the stated reporting limit.
  - There is a significant RCP QC variance (the Endrin breakdown standard results).
  - Low bias indicated by surrogate, LCS/LCSD and MS/MSD and MS/MSD surrogate.

Endrin "NDs" *(cont.)*

Q: Were precision, accuracy, or sensitivity affected by these nonconformances?

- Yes, accuracy and precision were affected.

Q: Do the nonconformances associated with "ND" results for Endrin for samples S-1, S-6, and S-10 affect the CSM?

- The "ND" locations are away from pesticide mixing and storage areas and are consistent with the CSM.
- However, Endrin could be present, just at lower concentrations than locations S-7, S-8, and S-9.

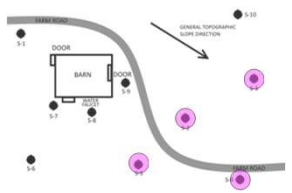
Low Endrin Detections

See magenta highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Low bias (QC lower than acceptance criteria) for:
  - Surrogate, LCS/LCSD and MS/MSD and MS/MSD surrogate.
  - Endrin breakdown standard > 15%.

DQA/DUE – Low Endrin Detections



Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370 [1]	0.038 [2]	0.018 [2]	0.035 [2]	0.009 [2]	<0.003 [1]	17.8 [4]	19.8 [4]	18.7 [4]	<0.00337 [1]
Endrin Aldehyde		<0.00370	0.015 [3]	0.007 [3]	0.013 [3]	<0.00355	<0.00351	6.9 [3]	7.7 [3]	7.3 [3]	<0.00337
Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
Dieldrin	0.038	<0.00370	0.0312 [5]	0.0102 [5]	0.0117 [5]	0.0358 [5]	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
4,4-DDT	1.8 [10]	<0.00370 [8]	1.78 [6]	0.345 [7]	1.65 [6]	1.51 [6]	<0.00351 [8]	0.827 [6]	0.321 [7]	1.65 [6]	<0.00337 [8]
Aldrin	0.04 [10]	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Heptachlor epoxide	0.067	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

Units = mg/kg

S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

[20] - RDEC applies to the sum of all forms of Endrin

[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

[4] Endrin close to RDEC - surrogate low bias, diluted out. Endrin breakdown check standard > 15% extremely low bias.

[5] Dieldrin - Surrogate low bias. MS/MSD within acceptance critiera.

[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[7] DDT low level detects - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[8] DDT NDs - Surrogate low, but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

Low Endrin Detections *(cont.)*

Q: For samples S-2, S-3, S-4, and S-5 with low concentrations, do these QC non-conformances affect the usability of the results when comparing to the RDEC?

- No.
- The nonconformances will not affect usability because these results are << RSR criteria and unlikely to exceed RSR criteria despite the low bias.

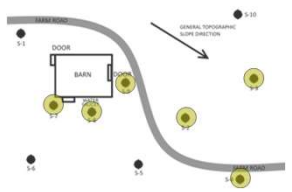
Endrin Breakdown Products

See olive highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Endrin breakdown products Endrin Aldehyde (EA) and Endrin Ketone (EK) were detected.

DQA/DUE – Endrin Breakdown Products



Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370 [1]	0.038 [2]	0.018 [2]	0.035 [2]	0.009 [2]	<0.003 [1]	17.8 [4]	19.8 [4]	18.7 [4]	<0.00337 [1]
Endrin Aldehyde		<0.00370	0.015 [3]	0.007 [3]	0.013 [3]	<0.00355	<0.00351	6.9 [3]	7.7 [3]	7.3 [3]	<0.00337
Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
Dieldrin	0.038	<0.00370	0.0312 [5]	0.0102 [5]	0.0117 [5]	0.0358 [5]	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
4,4-DDT	1.8 [10]	<0.00370 [8]	1.78 [6]	0.345 [7]	1.65 [6]	1.51 [6]	<0.00351 [8]	0.827 [6]	0.321 [7]	1.65 [6]	<0.00337 [8]
Aldrin	0.04 [10]	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Heptachlor epoxide	0.067	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

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S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

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[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

[4] Endrin close to RDEC - surrogate low bias, diluted out. Endrin breakdown check standard > 15% extremely low bias.

[5] Dieldrin - Surrogate low bias. MS/MSD within acceptance critiera.

[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[7] DDT low level detects - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[8] DDT NDs - Surrogate low, but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

Endrin Breakdown Products *(cont.)*

Q: EA and EK were detected at S-2, S-3, S-4, S-7, S-8, and S-9. Can these data be used to conclude that EA and EK are present at the site?

- No.
- The Endrin breakdown standard non-conformance indicates that the detection of EA and EK may have been caused by laboratory equipment in need of maintenance.
  - But it also does not mean EA and EK are NOT present.
  - Additional sampling and analysis would be necessary to evaluate the presence of EA and EK in soil at the site.

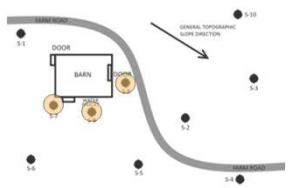
Endrin Results Close to RDEC

See orange non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Low bias (QC lower than acceptance criteria) for:
  - Surrogate, LCS/LCSD and MS/MSD and MS/MSD surrogate.
  - Endrin breakdown standard > 15%.

DQA/DUE – Endrin Results Close to RDEC



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Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
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Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

Endrin Results Close to RDEC *(cont.)*

Q: Is Endrin present in samples S-7, S-8, and S-9 at concentrations greater than RDEC?

- Very likely.
- Endrin may be present at a concentration greater than the RDEC because of any one of, or the cumulative effect of, multiple non-conformances indicating a low bias in the results.
  - ➢ LCS/LCSD, MS/MSD, and Endrin Breakdown Standard

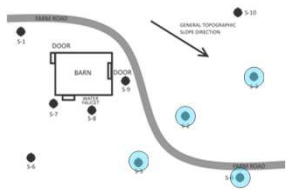
Dieldrin Detections Close to RDEC

See blue highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Surrogate low bias.
- MS/MSD recovery within acceptance criteria for Dieldrin.
  - CSM reminder - all samples were the same matrix.

DQA/DUE – Dieldrin Detections Close to RDEC



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4,4-DDT	1.8 [10]	<0.00370 [8]	1.78 [6]	0.345 [7]	1.65 [6]	1.51 [6]	<0.00351 [8]	0.827 [6]	0.321 [7]	1.65 [6]	<0.00337 [8]
Aldrin	0.04 [10]	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Heptachlor epoxide	0.067	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

Units = mg/kg

S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

[20] - RDEC applies to the sum of all forms of Endrin

[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

[4] Endrin close to RDEC - surrogate low bias, diluted out. Endrin breakdown check standard > 15% extremely low bias.

[5] Dieldrin - Surrogate low bias. MS/MSD within acceptance critiera.

[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[7] DDT low level detects - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[8] DDT NDs - Surrogate low, but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

Dieldrin Detections Close to RDEC *(cont.)*

Q: Do the reported concentrations for Dieldrin in samples S-2 and S-5 fit into the CSM?

- Yes. Results are consistent with the CSM.
  - S-2 and S-5 are located downslope of pesticide mixing and storage areas.
  - These results are lower than those from samples in closer proximity to mixing and storage areas.

Dieldrin Detections Close to RDEC *(cont.)*

Q: Dieldrin results for samples S-2 and S-5 are close to the RDEC. Can it be concluded that the results are below criteria?

- Yes, using multiple lines of evidence.
- Although the surrogate results may indicate a low bias, the MS/MSD QC data were acceptable for samples that are of the same matrix.
  - Because the MS/MSD is within acceptance criteria for Dieldrin and the matrix is the same, there is likely no impact to usability.
  - Whereas surrogate spikes are a measure of recovery for similar compounds, MS/MSD spikes use the actual target compound and are often a better measure of matrix effect when actual sample concentrations are low.

Dieldrin Detections Close to RDEC *(cont.)*

Q: What if… samples S-2 and S-5 were not of the same matrix as S-1? Could it be concluded that the results for S-2 and S-5 are below criteria?

- No.
- The matrix spike was performed for sample S-1. If the matrix for S-2 and S-5 are different, the MS/MSD QC data would not be applicable.
  - ➢ Low surrogate results and the lack of MS/MSD information to provide an additional line of evidence means the concentrations of Dieldrin could be greater than RDEC at these locations.

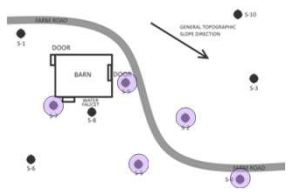
4,4’-DDT Detections Close to RDEC

See purple highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Surrogate low bias.
- MS/MSD recovery for 4,4’-DDT within acceptance criteria.
- High Relative Percent Difference (RPD) for MS/MSD for 4,4’-DDT, indicating non-directional bias.
  - CSM reminder - all samples were the same matrix.

DQA/DUE – 4,4'-DDT Detections Close to RDEC



Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370 [1]	0.038 [2]	0.018 [2]	0.035 [2]	0.009 [2]	<0.003 [1]	17.8 [4]	19.8 [4]	18.7 [4]	<0.00337 [1]
Endrin Aldehyde		<0.00370	0.015 [3]	0.007 [3]	0.013 [3]	<0.00355	<0.00351	6.9 [3]	7.7 [3]	7.3 [3]	<0.00337
Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
Dieldrin	0.038	<0.00370	0.0312 [5]	0.0102 [5]	0.0117 [5]	0.0358 [5]	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
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Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

Units = mg/kg

S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

[20] - RDEC applies to the sum of all forms of Endrin

[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

[4] Endrin close to RDEC - surrogate low bias, diluted out. Endrin breakdown check standard > 15% extremely low bias.

[5] Dieldrin - Surrogate low bias. MS/MSD within acceptance critiera.

[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[7] DDT low level detects - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[8] DDT NDs - Surrogate low, but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

4,4'-DDT Detections Close to RDEC *(cont.)*

Q: 4,4'-DDT was detected in samples S-2, S-4, S-5, and S-9 at concentrations close to the RDEC. Can it be concluded the results are below criteria?

- No.
- The concentrations of 4,4'-DDT may be greater than RDEC at these locations because of high RPD (low precision) for the MS/MSD.
  - Note: because the MS/MSD is within acceptance criteria for 4,4'-DDT, there is no impact to usability from the low surrogate results.

Q: What about sample S-7?

- Results for S-7 may require further consideration due to high RPD and reported concentration.

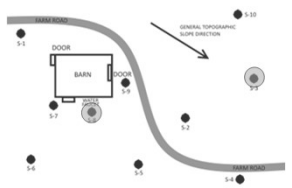
4,4’-DDT Detections << RDEC

See gray highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Surrogate low bias.
- MS/MSD recovery for 4,4’-DDT within acceptance criteria.
- High RPD for MS/MSD for 4,4’-DDT, non-directional bias.

DQA/DUE – 4,4'-DDT Detections Close to RDEC



Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370 [1]	0.038 [2]	0.018 [2]	0.035 [2]	0.009 [2]	<0.003 [1]	17.8 [4]	19.8 [4]	18.7 [4]	<0.00337 [1]
Endrin Aldehyde		<0.00370	0.015 [3]	0.007 [3]	0.013 [3]	<0.00355	<0.00351	6.9 [3]	7.7 [3]	7.3 [3]	<0.00337
Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
Dieldrin	0.038	<0.00370	0.0312 [5]	0.0102 [5]	0.0117 [5]	0.0358 [5]	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
4,4-DDT	1.8 [10]	<0.00370 [8]	1.78 [6]	0.345 [7]	1.65 [6]	1.51 [6]	<0.00351 [8]	0.827 [6]	0.321 [7]	1.65 [6]	<0.00337 [8]
Aldrin	0.04 [10]	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Heptachlor epoxide	0.067	<0.00370	<0.00366	<0.00362	<0.00358	<0.00355	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

Units = mg/kg

S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

[20] - RDEC applies to the sum of all forms of Endrin

[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

[4] Endrin close to RDEC - surrogate low bias, diluted out. Endrin breakdown check standard > 15% extremely low bias.

[5] Dieldrin - Surrogate low bias. MS/MSD within acceptance critiera.

[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[7] DDT low level detects - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[8] DDT NDs - Surrogate low, but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

4,4'-DDT Detections << RDEC *(cont.)*

Q: 4,4'-DDT was detected at concentrations well below the RDEC in samples S-3 and S-8. Can it be concluded the results are actually below criteria?

- Yes.
- Because these results are << RSR criteria and unlikely to exceed RSR criteria despite the high RPD (low precision).
  - Note: because the MS/MSD is within acceptance criteria for 4,4'-DDT, there is no impact to usability from the low surrogate results.

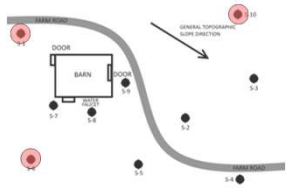
4,4’-DDT “NDs”

See red highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Surrogate low
- MS/MSD recovery for 4,4’-DDT within acceptance criteria.
- High RPD for MS/MSD for 4,4’-DDT, non-directional bias

DQA/DUE – 4,4'-DDT Detections Close to RDEC



Compound	RDEC (mg/kg)	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
Endrin	[20]	<0.00370 [1]	0.038 [2]	0.018 [2]	0.035 [2]	0.009 [2]	<0.003 [1]	17.8 [4]	19.8 [4]	18.7 [4]	<0.00337 [1]
Endrin Aldehyde		<0.00370	0.015 [3]	0.007 [3]	0.013 [3]	<0.00355	<0.00351	6.9 [3]	7.7 [3]	7.3 [3]	<0.00337
Endrin Ketone		<0.00370	0.012 [3]	0.005 [3]	0.011 [3]	<0.00355	<0.00351	5.3 [3]	5.9 [3]	5.6 [3]	<0.00337
Dieldrin	0.038	<0.00370	0.0312 [5]	0.0102 [5]	0.0117 [5]	0.0358 [5]	<0.00351	<0.0694 [9]	<0.0688 [9]	<0.0680 [9]	<0.00337
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Chlordane	0.49	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337
Toxaphene	0.56	<0.0370	<0.0366	<0.0362	<0.0358	<0.0355	<0.0351	<0.694 [9]	<0.688 [9]	<0.680 [9]	<0.0337

Notes:

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S-1 Matrix Spike and Matrix Spike Duplicate within acceptance critiera for all compound except Endrin.

MS/MSD results apply to all samples, same matrix.

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[1] Endrin NDs - low bias : surrogate, LCS/LCSD & MS/MSD and MS/MSD surrogate. Endrin breakdown check standard > 15% low bias.

[2] Endrin low-level detects - low bias: surrogate, LCS/LCSD, MS/MSD and MS and MSD. Endrin breakdown check standard > 15%.

[3] Endrin breakdown products.

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[6] DDT detects close to criteria - Surrogate low bias but MS/MSD within acceptance criteria. High RPD for MS/MSD, non-directional bias.

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[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

4,4’-DDT Detections << RDEC *(cont.)*

Q: 4,4’-DDT was not detected in samples S-1, S-6 and S-10. Do these non-conformances impact the usability of the 4,4’-DDT “NDs”?

- No.
- The Reporting Limits are << RSR criteria; therefore, the risk of being wrong in concluding that 4,4’-DDT is not present at those locations is quite low.

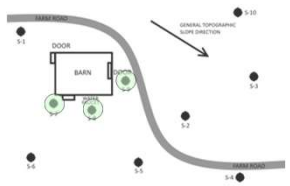
Reporting Limits > RDEC

See green highlighted non-conformances on the DQA Summary Table.

DQA Non-Conformances

- Compounds with RLs greater than RDEC:
  - Aldrin
  - Heptachlor epoxide
  - Dieldrin
  - Chlordane
  - Toxaphene

DQA/DUE – 4,4'-DDT Detections Close to RDEC



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[9] Aldrin, Heptachlor epoxide, Dieldrin, Chlordane and Toxaphene -- RLs > RDEC.
Also, surrogate recovery low bias, but MS/MSD within acceptance criteria. Surrogates were diluted out.

[10] Additional Polluting Substances Criteria

Reporting Limits > RDEC *(cont.)*

Q: Are concentrations of aldrin, heptachlor epoxide, dieldrin, chlordane, and toxaphene present in samples S-7, S-8, and S-9 at concentrations greater than the RDEC?

- Possibly.
- Because the reporting limits are greater than the RDEC, the data for these samples cannot be used to conclude that these compounds are present at concentrations less than the RDEC.

Overall Usability of Data *(cont.)*

Q: Is the quality of data generated during the investigation sufficient for the purpose of determining whether pesticides are present in soil at the site?

- Yes.
- The quality of the data is sufficient to determine that pesticides are present in soil at the site.
- The contamination appears to be distributed in a manner consistent with the CSM (historical farming activities and use of pesticides with storage and/or mixing of pesticides near the barn).

Overall Usability of Data *(cont.)*

Q: Is the quality of data generated during the investigation sufficient to determine if pesticides are present solely as the result of application?

- No.
- The pesticides around the barn are likely due to a release.
- We don't have enough data points to say whether the pesticides downslope of the barn are the result of releases at the barn or consistent with application.

Overall Usability of Data

Q: Can the data be used to conclude that pesticides are not present at concentrations greater than the RDEC?

- In some cases, yes.
  - ...when results for specific pesticides that are biased low are well below RDEC.
  - ...when NDs are associated with reporting limits that are well below RDEC.
- In some cases, no.
  - ...when reported results are close to RDEC at several sample location, and the results are biased low.

    In these instances, it would be prudent to consider that the actual concentrations may exceed the RDEC at several locations.

CSM Data Gaps

Endrin may be present at concentrations greater than the RDEC at sampling locations S-7, S-8, and S-9.

Significant	Not Significant
✓	

CSM Data Gaps

4,4'-DDT may be present at concentrations greater than the RDEC at S-2, S-4, S-5, and S-9 (and possibly S-7).

Significant	Not Significant
✓	

- Endrin in S-7 and S-9 already requires additional evaluation.
- S-2, S-4, and S-5 require further evaluation

CSM Data Gaps

Reporting Limits are greater than RDEC for aldrin, heptachlor epoxide, chlorodane, toxaphene and dieldrin (S-7, S-8, and S-9). These analytes may be present in soil at concentrations below the stated reporting limits but still above the RDEC.

Significant	Not Significant
	✓

- Endrin at those locations already requires further evaluation.

CSM Data Gaps

Endrin aldehyde and endrin ketone may or may not be present in samples S-2, S-3, S-4, S-7, S-8, and S-9.

Significant	Not Significant
	✓

- The reported concentrations in S-2, S-3, and S-4 are well below RDEC.
- Endrin in S-7, S-8, and S-9 already requires additional evaluation.

DUE Step 3: Document DQA/DUE

Case Study #2

Passion provides purpose, but data drives decisions.
~Andy Dunn

DUE Worksheet: Part 2 – Usability by Compound

Data Usability Evaluation Worksheet – Part 2
Case Study 2 – Data Usability Summary Statement

The following is a summary statement that describes how the analytical data set relied upon is of adequate quality and of sufficient accuracy, precision, and sensitivity for the intended purpose.

The intended purpose of the investigation is to provide information to a potential buyer of a former agricultural property with respect to the potential presence of pesticides on the property and the potential remedial costs that might be associated with developing the property for residential use. This would include assessing whether or not remediation would be necessary to meet Residential Direct Exposure Criteria identified in the RSRs.

Data Usability Evaluation by Compound

Endrin

The laboratory Endrin/DDT breakdown standard indicated that significant breakdown of Endrin occurred at the injection port. In addition, both the LCS/LCSD and MS/MSD percent recoveries for Endrin were outside RCP acceptance limits. All of the sample results are biased low for Endrin.

- *Endrin Non-Detects (Samples S-1, S-6, and S-10)*

  Endrin was reported as "ND" in samples S-1, S-6, and S-10. As indicated in the DQA/DUE guidance, when the lab Endrin standard breakdown is greater than 15% (in this case it is 50%), ND results cannot be used to determine that Endrin was not present in the sample at the reporting limit achieved for such samples. Therefore, Endrin may be present in samples S-1, S-6, and S-7.

- *Endrin Detections at Lower Concentrations (Samples S-2, S-3, S-4, and S-5)*

  The DQA/DUE guidance also indicates that "if the detected concentration or RL for which the result is reported as ND are significantly below the RSR criteria, the bias indicated by the QC information has limited impact on usability of the data." Because these results are well below the RDEC, these results are usable to determine that a release of Endrin occurred. These results are usable for comparison to the RDEC, i.e., the reported Endrin concentrations are much lower than the RDEC.

- *Endrin Detections Near RDEC (Samples S-7, S-8, and S-9)*

  Endrin was reported in samples S-7, S-8, and S-9 at concentrations close to the RDEC. In this case, the low bias must be considered because the actual concentration of Endrin may be greater than the RDEC. The values are usable to determine that a release of Endrin occurred but are not usable to conclude that the levels are less than the RDEC. Using professional judgment, the environmental professional could appropriately conclude that the concentrations present at the site might be higher than the RDEC. The locations with the highest concentrations are consistent with the CSM because they are near documented pesticide mixing and storage locations (the barn).

Endrin Aldehyde and Endrin Ketone
(Samples S-2, S-3, S-4, S-7, S-8, and S-9)

These compounds are reported in samples S-2, S-3, S-4, S-7, S-8, S-9, but it is not known if they are present due to Endrin breakdown at the injection port or if they are present in soil on the site. The data are not usable to determine whether or not those compounds are present at the site, but even if they were present at the site, the reported concentrations are low enough that one can conclude that the concentrations at the site do not exceed the RDEC.

Dieldrin Samples
(S-2, S-3, S-4, and S-5)

Dieldrin was detected in samples S-2, S-3, S-4, and S-5. The surrogate percent recovery is low for all samples. To evaluate usability, multiple lines of QC information can be used. The other QC information that can be evaluated are the LCS, LCSD, MS and MSD. The percent recoveries of the LCS, LCSD, MS, and MSD for the Dieldrin are within RCP acceptance limits. The data are usable to determine that a release of Dieldrin occurred and that the concentrations are less than the RDEC.

4,4'- DDT

The relative percent difference for the MS/MSD is greater than RCP acceptance criteria. The high RPD indicates a lack of sample homogeneity and raises questions regarding representativeness. The only QC nonconformance for these samples is the high relative percent difference for the MS/MSD. The environmental professional must consider representativeness of the sample results in relation to the CSM.

- *4,4'- DDT Non-Detects (Samples S-1, S-6, and S-10)*

  4,4'- DDT was reported as "ND" in samples S-1, S-6, and S-10. Because the RL is quite low compared to the RDEC and the high RPD is indicative of non-directional bias, the data are usable to conclude that evidence of a release of 4,4'- DDT was not found in these samples. The RL was significantly less than the RDEC, therefore the data are usable to compare to RDEC, i.e., concentrations of 4,4'- DDT are less than the RDEC.

- *4,4'- DDT Detections at Lower Concentrations (Samples S-3, S-7, and S-8)*

  4,4'- DDT was detected in samples S-3 and S-8 at concentrations well below the RDEC and at a concentration somewhat below the RDEC in sample S-7. The data are usable to determine that a release of 4,4'- DDT occurred at locations S-3, S-7, S-8, and that the concentrations are less than the RDEC at locations S-3 and S-8. Concluding that the concentration at location S-7 is below the RDEC requires further consideration.

- *4,4'- DDT Detections Near RDEC (Samples S-2, S-4, S-5, S-7, and S-9)*

  4,4'- DDT was reported in samples S-2, S-4, S-5, and S-9 at concentrations close to the RDEC. In this case, the high RPD for the MS/MSD must be considered because the actual concentrations of 4,4'- DDT at one or more locations may be greater than the RDEC. The values are usable to determine that a release of 4,4'- DDT occurred but are not usable to conclude that the concentrations at any of those locations are less than the RDEC. Using professional judgment, it would be appropriate to conclude that the concentrations could be greater than the RDEC at one or more of the sampled locations or at other locations in the vicinity. Determining whether the reported concentration for sample S-7 is sufficiently below the RDEC to support a conclusion that the actual concentration does not exceed the RDEC requires further consideration, including the amount that the RPD is outside the acceptance criterion and the reported concentration in the sample, as well as the CSM. In this case, other data will drive decision-making (i.e., high concentrations for Endrin).

Aldrin, Heptachlor Epoxide, Dieldrin, Chlorodane, and Toxaphene
(Samples S-7, S-8, and S-9)

Because the Endrin concentrations in samples S-7, S-8, and S-9 were high (above the highest concentration used to develop the calibration curve), aliquots of these samples were diluted in order to get the results within the calibration curve. The surrogates were diluted out, and the RLs were raised in accordance with elevated dilution factor. The RLs for Aldrin, Heptachlor Epoxide, Dieldrin, Chlordane, and Toxaphene for samples S-7, S-8, and S-9 are greater than the RDEC and cannot be used to determine compliance with the RDEC. These results can be used to determine that Aldrin, Heptachlor Epoxide, Dieldrin, Chlordane, and Toxaphene were not present at the elevated RLs that were achieved but could be present below those concentrations.

DUE Worksheet: Part 2 Summary Statement

The following is a summary statement that describes how the analytical data set relied upon is of adequate quality and of sufficient accuracy, precision, and sensitivity for the intended purpose.

The intended purpose of the investigation is to provide information to a potential buyer of a former agricultural property with respect to the potential presence of pesticides on the property and the potential remedial costs that might be associated with developing the property for residential use. This would include assessing whether or not remediation would be necessary to meet Residential Direct Exposure Criteria identified in the RSRs.

DUE Worksheet: Part 2
Endrin Narrative

The laboratory Endrin/DDT breakdown standard indicated that significant breakdown of Endrin occurred at the injection port. In addition, both the LCS/LCSD and MS/MSD percent recoveries for Endrin were outside RCP acceptance limits. All of the sample results are biased low for Endrin.

- **Endrin Non-Detects (Samples S-1, S-6, and S-10)**

  Endrin was reported as "ND" in samples S-1, S-6, and S-10. As indicated in the DQA/DUE guidance, when the lab Endrin standard breakdown is greater than 15% (in this case it is 50%), ND results cannot be used to determine that Endrin was not present in the sample at the reporting limit achieved for such samples. Therefore, Endrin may be present in samples S-1, S-6, and S-7.

- **Endrin Detections at Lower Concentrations (Samples S-2, S-3, S-4, and S-5)**

  The DQA/DUE guidance also indicates that "if the detected concentration or RL for which the result is reported as ND are significantly below the RSR criteria, the bias indicated by the QC information has limited impact on usability of the data." Because these results are well below the RDEC, these results are usable to determine that a release of Endrin occurred. These results are usable for comparison to the RDEC, i.e., the reported Endrin concentrations are much lower than the RDEC.

- **Endrin Detections Near RDEC (Samples S-7, S-8, and S-9)**

  Endrin was reported in samples S-7, S-8, and S-9 at concentrations close to the RDEC. The locations with the highest concentrations are consistent with the CSM because they are near documented pesticide mixing and storage locations (the barn). In this case, the low bias must be considered because the actual concentration of Endrin may be greater than the RDEC. The values are usable to determine that a release of Endrin occurred but are not usable to conclude that the levels are less than the RDEC. Using professional judgment, the environmental professional could appropriately conclude that the concentrations present at the site might be higher than the RDEC.

DUE Worksheet: Part 2
4,4'-DDT Narrative

The relative percent difference for the MS/MSD is greater than RCP acceptance criteria. The high RPD indicates a lack of sample homogeneity and raises questions regarding representativeness. The only QC nonconformance for these samples is the high relative percent difference for the MS/MSD. The environmental professional must consider representativeness of the sample results in relation to the CSM.

- **4,4'- DDT Non-Detects (Samples S-1, S-6, and S-10)**

  4,4'- DDT was reported as "ND" in samples S-1, S-6, and S-10. Because the RL is quite low compared to the RDEC and the high RPD is indicative of non-directional bias, the data are usable to conclude that evidence of a release of 4,4'- DDT was not found in these samples. The RL was significantly less than the RDEC, therefore the data are usable to compare to RDEC, i.e., concentrations of 4,4'- DDT are less than the RDEC.

- **4,4'- DDT Detections at Lower Concentrations (Samples S-3, S-7, and S-8)**

  4,4'- DDT was detected in samples S-3 and S-8 at concentrations well below the RDEC and at a concentration somewhat below the RDEC in sample S-7. The data are usable to determine that a release of 4,4'- DDT occurred at locations S-3, S-7, S-8, and that the concentrations are less than the RDEC at locations S-3 and S-8. Concluding that the concentration at location S-7 is below the RDEC requires further consideration.

- **4,4'- DDT Detections Near RDEC (Samples S-2, S-4, S-5, S-7, and S-9)**

  4,4'- DDT was reported in samples S-2, S-4, S-5, and S-9 at concentrations close to the RDEC. In this case, the high RPD for the MS/MSD must be considered because the actual concentrations of 4,4'- DDT at one or more locations may be greater than the RDEC. The values are usable to determine that a release of 4,4'- DDT occurred but are not usable to conclude that the concentrations at any of those locations are less than the RDEC. Using professional judgment, it would be appropriate to conclude that the concentrations could be greater than the RDEC at one or more of the sampled locations or at other locations in the vicinity. Determining whether the reported concentration for sample S-7 is sufficiently below the RDEC to support a conclusion that the actual concentration does not exceed the RDEC requires further consideration. In this case, Endrin will drive decision-making.

DUE Worksheet: Combined DQA/DUE/Data Gap

Affected Samples	Affected Parameters	Identified Issue	Potential Bias	Sample Result (mg/kg)	Resolution
S-1	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	ND<0.00370	No further action. RL sufficiently low.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	ND<0.00370	
S-2	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	0.038	No further action. Total endrin concentrations well below RDEC.
	Endrin aldehyde Endrin Ketone	Endrin breakdown products detected. Possible equipment maintenance issue.	Possible high	0.015 0.012	
	Dieldrin	Surrogate recovery low, but MS/MSD QC were acceptable.	Bias unlikely	0.0312	No further action based on MS/MSD.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	1.78	Detection near RDEC; possible exceedance.
S-3	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	0.018	No further action. Total endrin concentrations well below RDEC.
	Endrin aldehyde Endrin Ketone	Endrin breakdown products detected. Possible equipment maintenance issue.	Possible high	0.007 0.005	
	Dieldrin	Surrogate recovery low, but MS/MSD QC were acceptable.	Bias unlikely	0.0102	No further action. Detection well below RDEC.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	0.345	No further action. Detection well below RDEC.
S-4	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	0.035	No further action. Total endrin concentrations well below RDEC.
	Endrin aldehyde Endrin Ketone	Endrin breakdown products detected. Possible equipment maintenance issue.	Possible high	0.013 0.011	
	Dieldrin	Surrogate recovery low, but MS/MSD QC were acceptable.	Bias unlikely	0.0117	No further action. Detections well below RDEC.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	1.65	Detection near RDEC; possible exceedance.

Organize information in a way that will help you make decisions.

Make key decision points obvious.

DUE Worksheet: Combined DQA/DUE/Data Gap

Affected Samples	Affected Parameters	Identified Issue	Potential Bias	Sample Result (mg/kg)	Resolution
S-5	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	0.009	No further action. Detection well below RDEC.
	Dieldrin	Surrogate recovery low, but MS/MSD QC were acceptable.	Bias unlikely	0.0358	No further action based on MS/MSD.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	1.51	Detection near RDEC; possible exceedance.
S-6	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	ND<0.003	No further action. RL sufficiently low.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	ND<0.00351	
S-7	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Extremely low	17.8	Total endrin likely > RDEC.
	Endrin aldehyde Endrin Ketone	Endrin breakdown products detected. Possible equipment maintenance issue.	Possible high	6.9 5.3	
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	0.827	Elevated detection; needs further evaluation to demonstrate compliance with RDEC.
	Aldrin Heptachlor epoxide Dieldrin Chlordane Toxaphene	RL > RDEC. Surrogate recovery low. MS/MSD within acceptance criteria. Surrogates diluted out.	RL > RDEC	ND	Cannot determine if these substances were released at concentrations > RDEC.

Figure 1

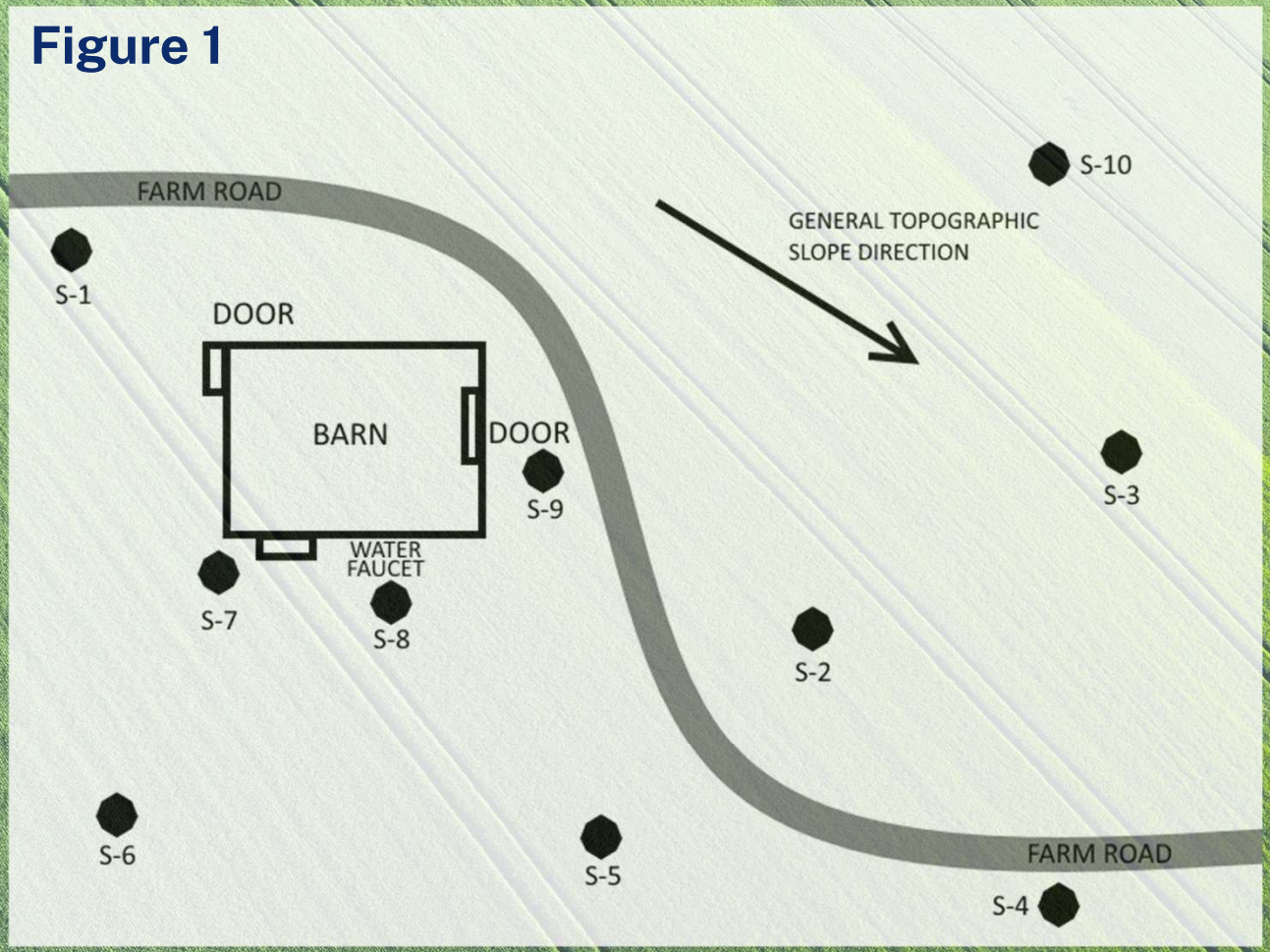

FARM ROAD
S-1
DOOR
BARN
DOOR
S-9
WATER
FAUCET
S-7
S-8
S-10
GENERAL TOPOGRAPHIC
SLOPE DIRECTION
S-3
S-2
S-6
S-5
FARM ROAD
S-4

Figure 1 (CSM)

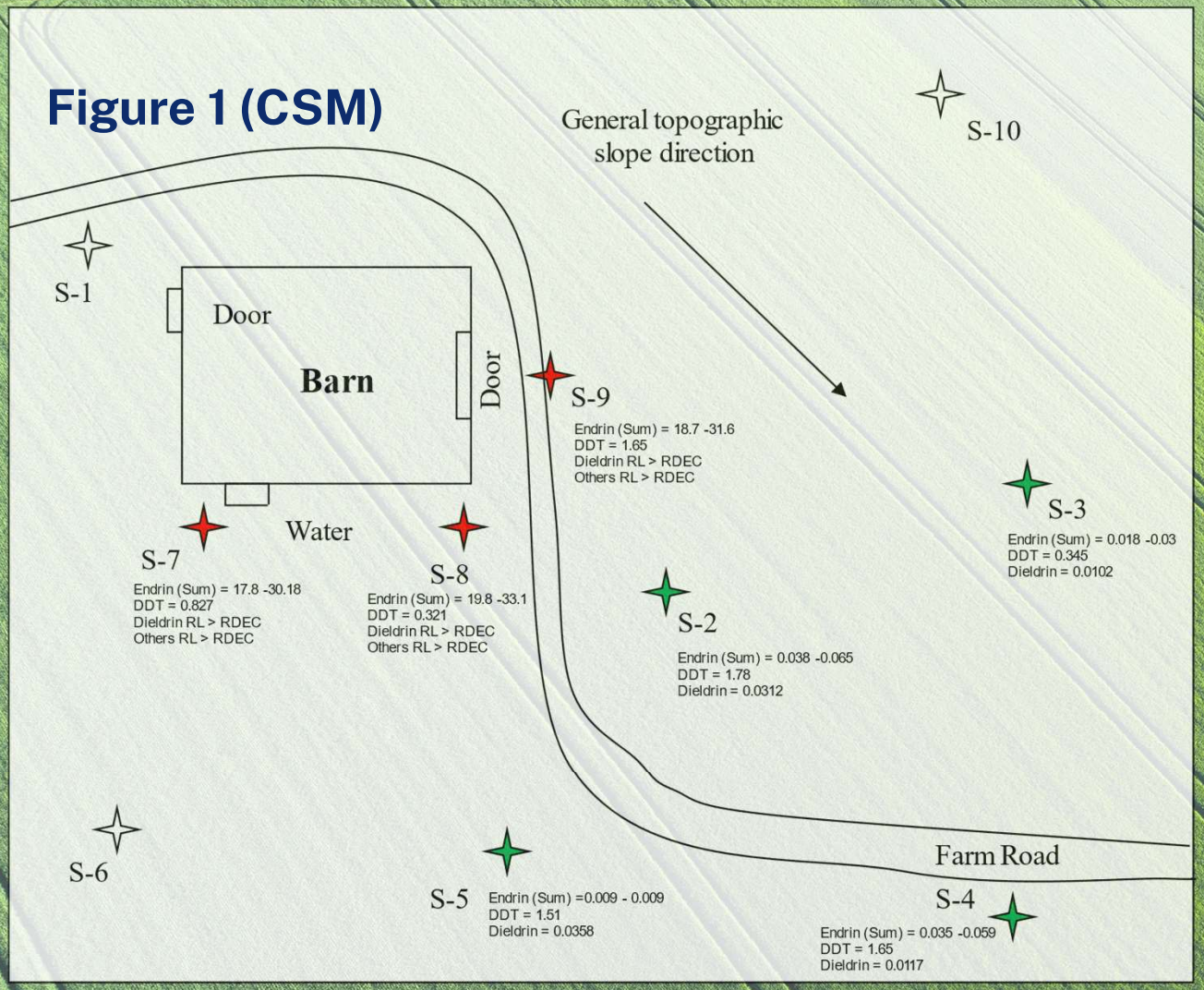
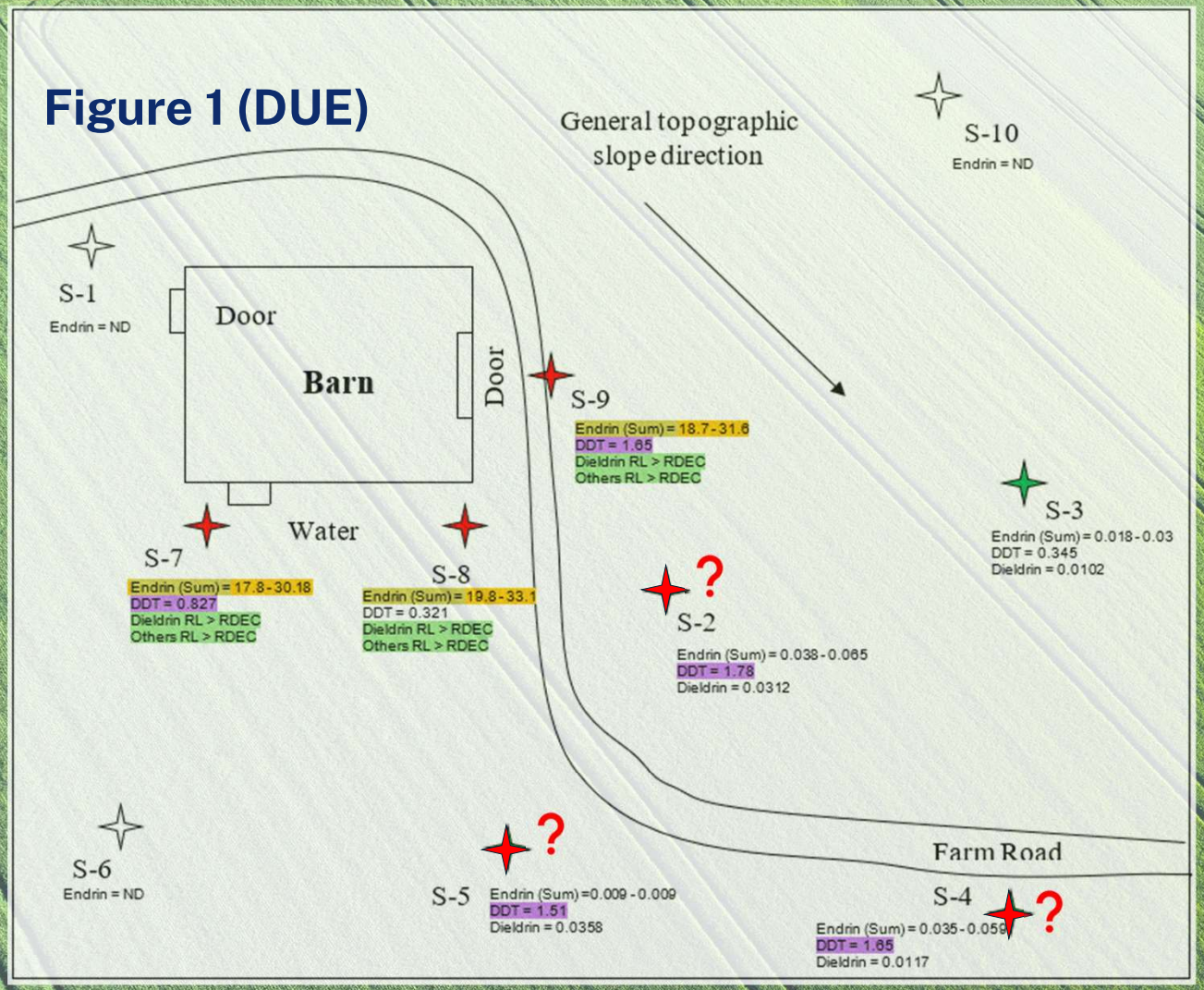

General topographic slope direction
S-10
S-1
Door
Barn
Door
S-9
Endrin (Sum) = 18.7 -31.6
DDT = 1.65
Dieldrin RL > RDEC
Others RL > RDEC
S-3
Endrin (Sum) = 0.018 -0.03
DDT = 0.345
Dieldrin = 0.0102
Water
S-7
Endrin (Sum) = 17.8 -30.18
DDT = 0.827
Dieldrin RL > RDEC
Others RL > RDEC
S-8
Endrin (Sum) = 19.8 -33.1
DDT = 0.321
Dieldrin RL > RDEC
Others RL > RDEC
S-2
Endrin (Sum) = 0.038 -0.065
DDT = 1.78
Dieldrin = 0.0312
S-6
S-5
Endrin (Sum) =0.009 - 0.009
DDT = 1.51
Dieldrin = 0.0358
Farm Road
S-4
Endrin (Sum) = 0.035 -0.059
DDT = 1.65
Dieldrin = 0.0117
Pesticides not detected
Pesticides detected < RDEC
Pesticides detected > RDEC

Figure 1 (DUE)

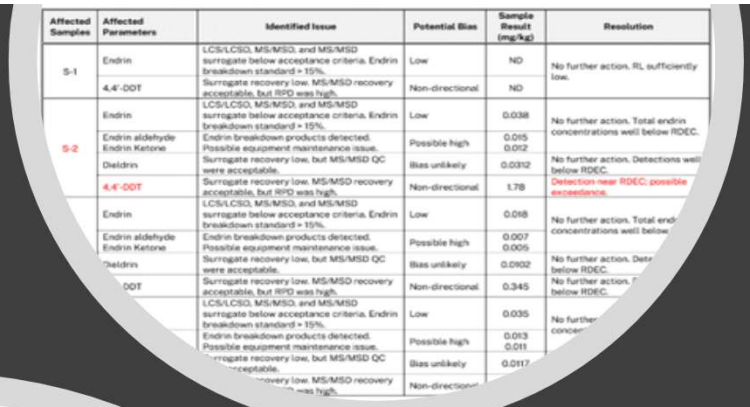


Pesticides not detected

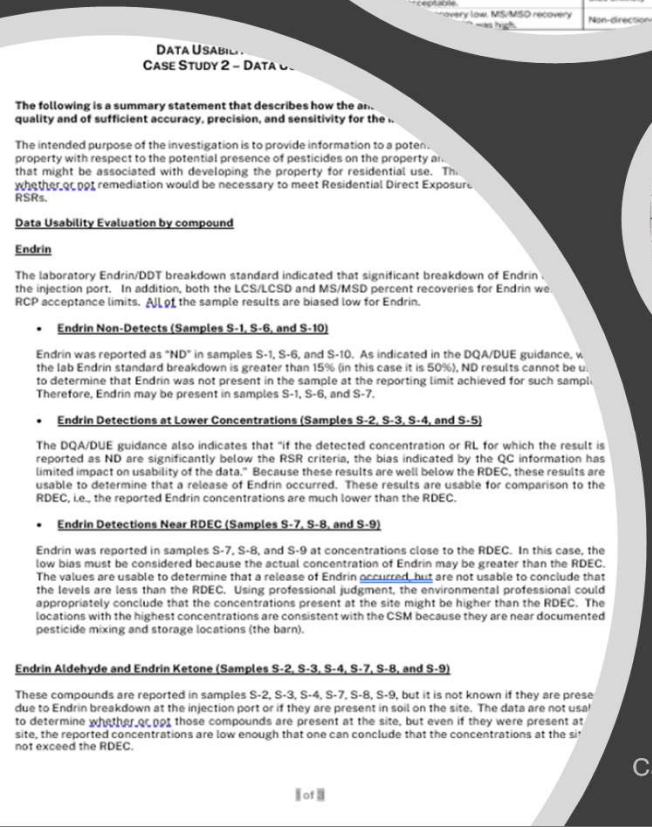
Pesticides detected < RDEC

Pesticides detected > RDEC

Highlights = QA/QC non-conformances from DQA summary that could affect decisions



Affected Samples	Affected Parameters	Identified Issue	Potential Bias	Sample Result (mg/kg)	Resolution
S-1	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	ND	No further action. RL sufficiently low.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	ND	
S-2	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	0.038	No further action. Total endrin concentrations well below RDEC.
	Endrin aldehyde Endrin Ketone	Endrin breakdown products detected. Possible equipment maintenance issue.	Possible high	0.015 0.012	
	Dieldrin	Surrogate recovery low, but MS/MSD QC were acceptable.	Bias unlikely	0.0312	No further action. Detections well below RDEC.
	4,4'-DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	1.78	Detection near RDEC; possible exceedance.
S-3	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	0.018	No further action. Total endrin concentrations well below RDEC.
	Endrin aldehyde Endrin Ketone	Endrin breakdown products detected. Possible equipment maintenance issue.	Possible high	0.007 0.005	
	Dieldrin	Surrogate recovery low, but MS/MSD QC were acceptable.	Bias unlikely	0.0102	No further action. Detections well below RDEC.
	DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	0.345	No further action. Total endrin concentrations well below RDEC.
S-5	Endrin	LCS/LCSD, MS/MSD, and MS/MSD surrogate below acceptance criteria. Endrin breakdown standard > 15%.	Low	0.035	No further action. Total endrin concentrations well below RDEC.
	Endrin aldehyde Endrin Ketone	Endrin breakdown products detected. Possible equipment maintenance issue.	Possible high	0.013 0.011	
	Dieldrin	Surrogate recovery low, but MS/MSD QC were acceptable.	Bias unlikely	0.0117	No further action. Detections well below RDEC.
	DDT	Surrogate recovery low. MS/MSD recovery acceptable, but RPD was high.	Non-directional	0.0117	No further action. Total endrin concentrations well below RDEC.



DATA USABILITY
CASE STUDY 2 – DATA

The following is a summary statement that describes how the an… quality and of sufficient accuracy, precision, and sensitivity for the …

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Data Usability Evaluation by compound

Endrin

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- **Endrin Non-Detects (Samples S-1, S-6, and S-10)**

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- **Endrin Detections at Lower Concentrations (Samples S-2, S-3, S-4, and S-5)**

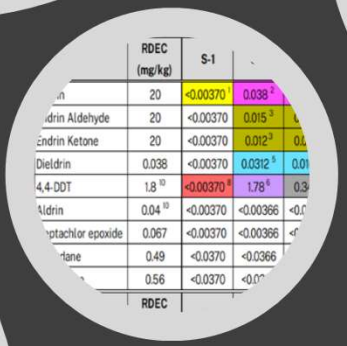
  The DQA/DUE guidance also indicates that "if the detected concentration or RL for which the result is reported as ND are significantly below the RSR criteria, the bias indicated by the QC information has limited impact on usability of the data." Because these results are well below the RDEC, these results are usable to determine that a release of Endrin occurred. These results are usable for comparison to the RDEC, i.e., the reported Endrin concentrations are much lower than the RDEC.

- **Endrin Detections Near RDEC (Samples S-7, S-8, and S-9)**

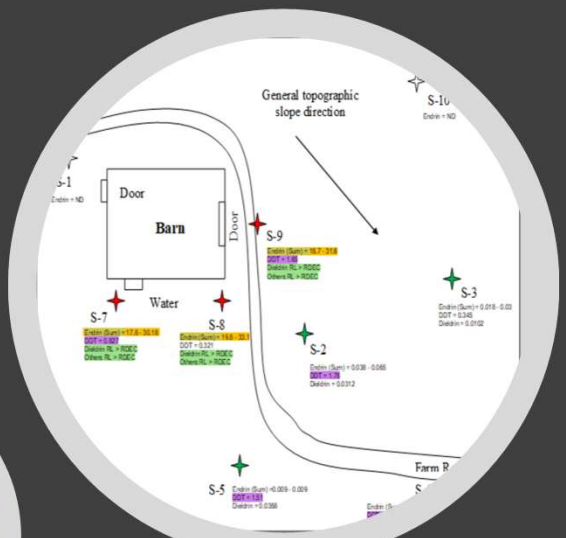
  Endrin was reported in samples S-7, S-8, and S-9 at concentrations close to the RDEC. In this case, the low bias must be considered because the actual concentration of Endrin may be greater than the RDEC. The values are usable to determine that a release of Endrin occurred, but are not usable to conclude that the levels are less than the RDEC. Using professional judgment, the environmental professional could appropriately conclude that the concentrations present at the site might be higher than the RDEC. The locations with the highest concentrations are consistent with the CSM because they are near documented pesticide mixing and storage locations (the barn).

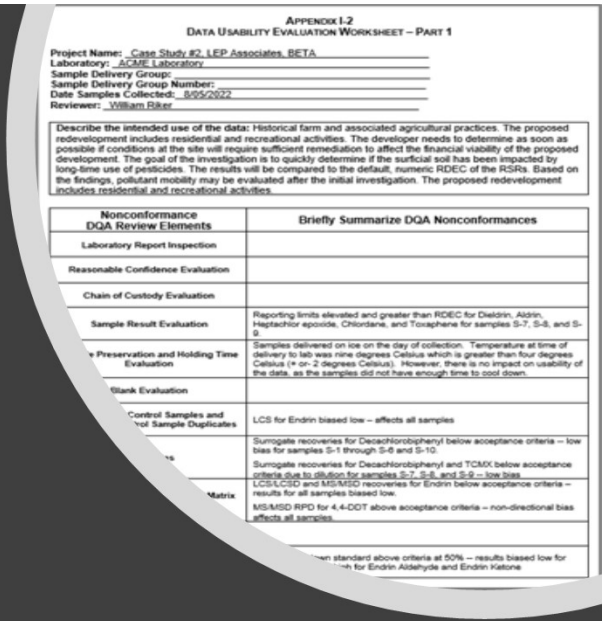
Endrin Aldehyde and Endrin Ketone (Samples S-2, S-3, S-4, S-7, S-8, and S-9)

These compounds are reported in samples S-2, S-3, S-4, S-7, S-8, S-9, but it is not known if they are prese… due to Endrin breakdown at the injection port or if they are present in soil on the site. The data are not usa… to determine whether or not those compounds are present at the site, but even if they were present at … site, the reported concentrations are low enough that one can conclude that the concentrations at the si… not exceed the RDEC.



	RDEC (mg/kg)	S-1	
…in	20	<0.00370 [1]	0.038 [2]
…drin Aldehyde	20	<0.00370	0.015 [3]
…ndrin Ketone	20	<0.00370	0.012 [3]
Dieldrin	0.038	<0.00370	0.0312 [5]
4,4-DDT	1.8 [10]	<0.00370 [8]	1.78 [6]
Aldrin	0.04 [10]	<0.00370	<0.00366
…ptachlor epoxide	0.067	<0.00370	<0.00366
…rdane	0.49	<0.0370	<0.0366
	0.56	<0.0370	<0.0…
	RDEC		



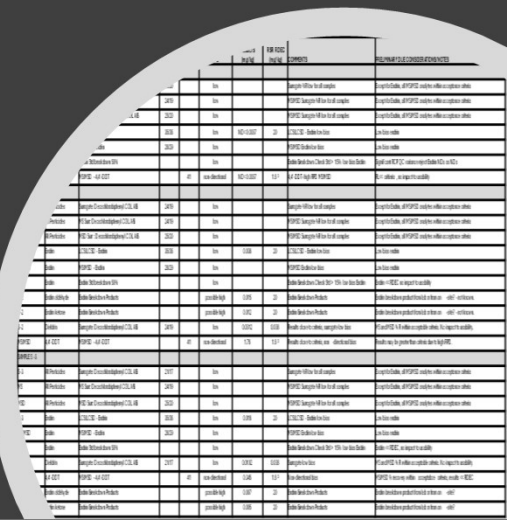


APPENDIX I-2
DATA USABILITY EVALUATION WORKSHEET – PART 1

Project Name: Case Study #2, LEP Associates, BETA
Laboratory: ACME Laboratory
Sample Delivery Group:
Sample Delivery Group Number:
Date Samples Collected: 8/05/2022
Reviewer: William Riker

Describe the intended use of the data: Historical farm and associated agricultural practices. The proposed redevelopment includes residential and recreational activities. The developer needs to determine as soon as possible if conditions at the site will require sufficient remediation to affect the financial viability of the proposed development. The goal of the investigation is to quickly determine if the surficial soil has been impacted by long-time use of pesticides. The results will be compared to the default, numeric RDEC of the RSRs. Based on the findings, pollutant mobility may be evaluated after the initial investigation. The proposed redevelopment includes residential and recreational activities.

Nonconformance DQA Review Elements	Briefly Summarize DQA Nonconformances
Laboratory Report Inspection	
Reasonable Confidence Evaluation	
Chain of Custody Evaluation	
Sample Result Evaluation	Reporting limits elevated and greater than RDEC for Dieldrin, Aldrin, Heptachlor epoxide, Chlordane, and Toxaphene for samples S-7, S-8, and S-9.
…e Preservation and Holding Time Evaluation	Samples delivered on ice on the day of collection. Temperature at time of delivery to lab was nine degrees Celsius which is greater than four degrees Celsius (+ or- 2 degrees Celsius). However, there is no impact on usability of the data, as the samples did not have enough time to cool down.
…Blank Evaluation	
…Control Samples and …ol Sample Duplicates	LCS for Endrin biased low – affects all samples
	Surrogate recoveries for Decachlorobiphenyl below acceptance criteria – low bias for samples S-1 through S-6 and S-10.
	Surrogate recoveries for Decachlorobiphenyl and TCMX below acceptance criteria due to dilution for samples S-7, S-8, and S-9 – low bias
…Matrix	LCS/LCSD and MS/MSD recoveries for Endrin below acceptance criteria – results for all samples biased low.
	MS/MSD RPD for 4,4-DDT above acceptance criteria – non-directional bias affects all samples
	…n standard above criteria at 50% – results biased low for …r Endrin Aldehyde and Endrin Ketone



DUE Preparation Tools

Example DQA/DUE Report Narrative

A Data Quality Assessment (DQA) and a Data Usability Evaluation (DUE) were performed on the data generated during the investigation of the former agricultural property that is proposed to be redeveloped for mixed commercial/residential/recreational purposes. Ten soil samples were collected from the site and submitted to a state-certified analytical laboratory for pesticides using RCP Method 8081.

Intended Data Use

The investigation was conducted to determine the following:

- The degree and extent to which pesticide use resulted in residual pesticide contamination in the soil.
- If pesticide contamination is due to the application of pesticides or releases.
- If pesticide concentrations in soil exceed the default RDEC.
- Potential costs of remediation necessary to facilitate redevelopment for residential use.

Example DQA/DUE Report Narrative

Data Quality Assessment

A summary of the issues identified during the DQA is provided on the DQA Worksheet included in *Appendix Q* of this report. The DQA identified several QA/QC issues for constituents of concern (COCs) at the site:

- The major issues for COCs were related to surrogate recoveries, matrix spike/matrix spike duplicate results, laboratory control samples, laboratory control sample duplicates that resulted in potential low biases for COCs.
- Elevated reporting limits were reported for several COCs.
- Equipment maintenance issues resulted in the breakdown of Endrin during the analytical process.

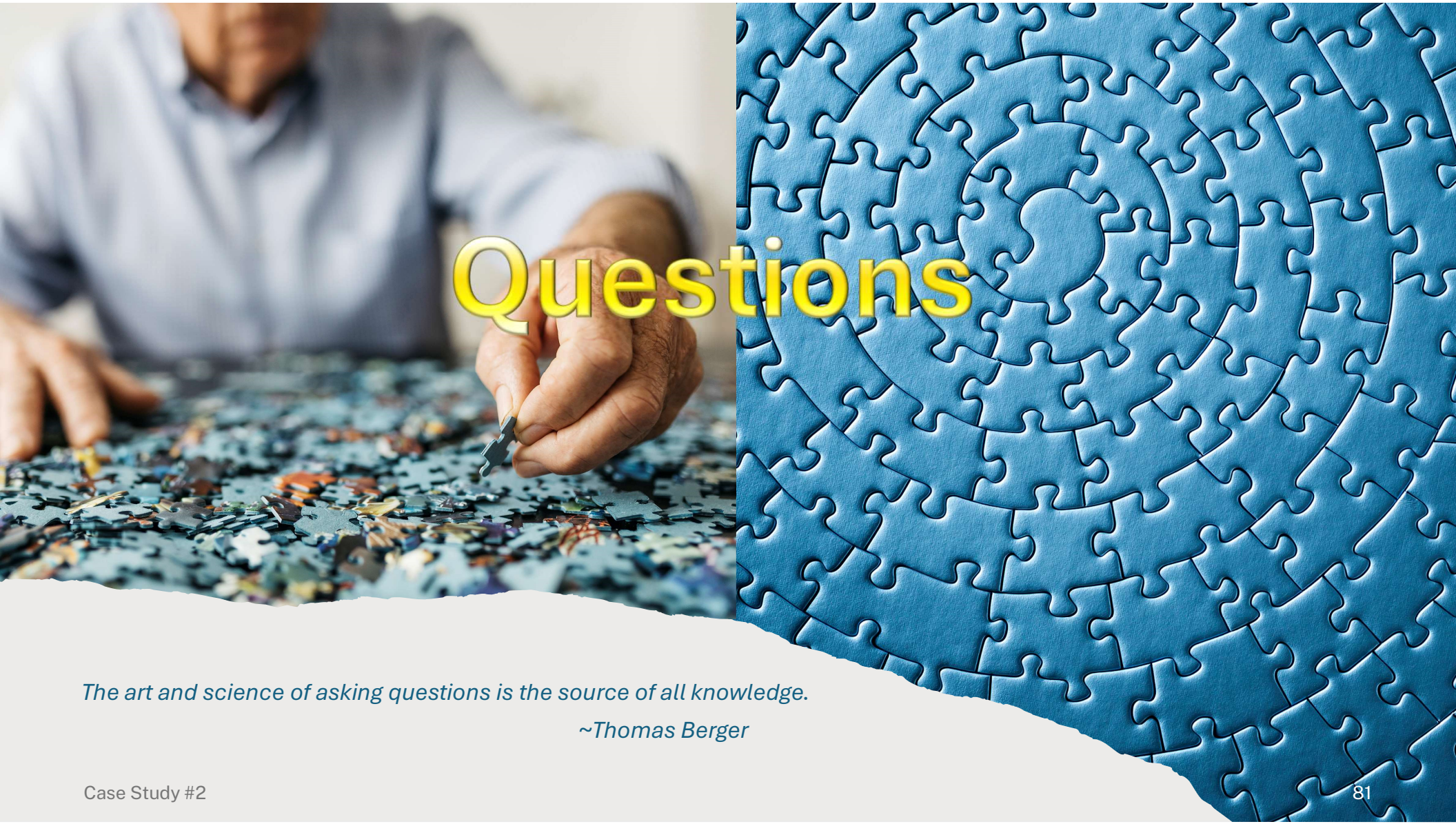
Example DQA/DUE Report Narrative

Data Usability Evaluation

Based on the above findings from the DQA and DUE, the quality of the analytical data is sufficient for the following:

- The data confirmed that pesticides are present in surficial soil with the highest concentrations located at the mixing and storage areas by the barn. Lower concentrations of pesticides are present downslope, at S-2 through S-5. It could not be determined that the pesticides were due solely to application.
- Concentrations of Endrin around the barn at S-7, S-8, and S-9 are likely due to releases associated with mixing and storage. While there are some significant non-conformances related to the reported values, the concentrations are expected to exceed the RDEC, and additional action should be planned to achieve compliance with the residential criteria.
- Due to data non-conformances and elevated reporting limits for some pesticides, the following could not be determined:
    - If pesticides other than Endrin exceed the RDEC in the barn area.
    - If 4,4'-DDT in downslope areas represented by locations S-2, S-4, and S-5 exceed the RDEC.

  Additional characterization and/or remedial actions are necessary to demonstrate compliance with the RDEC for these parameters/locations.



The art and science of asking questions is the source of all knowledge.

~Thomas Berger

Panel Discussion

Panelists:

Tina Clemmey
ENSAFE

Rebecca Merz
Phoenix Laboratories

Jeffrey Smith
CET Labs

Christina Venable Loureiro

Kevin Vanderveer
DEEP | Remediation Division

Contact Info

Veronica “Roni” Tanguay
Environmental Analyst
Remediation Division

veronica.tanguay@ct.gov

(860) 424-3669


The End