LABORATORY DATA QUALITY ASSESSMENT AND DATA USABILITY EVALUATION FOR ENVIRONMENTAL INVESTIGATION AND REMEDIATION PROJECTS

Schedule
9:00 – 9:20 AM (20 minutes): Introduction and overview of training
Peter Hill
Nora Conlon

9:20 – 9:50 AM (30 minutes): Introduction and overview of the RCPs
Paul Clark

9:50 – 10:10 AM (30 minutes): Roles and Responsibilities for DQA/DUE Process and Documentation
Lisandro Suarez
Allison Forrest-Laiuppa

10:10 – 10:30 AM (20 minutes): “Pop Quiz”
Rebecca Mertz

10:30 – 10:45 AM (15 minute): Break

10:45 – 12:15 PM (1.5 hours): Data Quality Assessment
Jim Occhialini

12:15-1:00 PM (45 minutes): Lunch

1:00 – 3:15 PM (2.25 hours): DQA/DUE Issues and Solutions with Interactive Case Studies
Presenters: Mike Ainsworth, Christina Clemmey, Dr. Gail Batchelder, and William Flick
Assistants for Case Studies: Tamara Burke Devine, P.E., LEP, Nora Conlon, and David Clymer (maybe)

3:15 – 3:45 PM (30 minutes): DEEP/LEP Panel Discussion
Moderator: Nora Conlon
Panelist: Peter Hill, Jim Occhialini, Mike Ainsworth, William Flick, Christina Clemmey, and Nicole Leja

3:45 – 4:00 PM (15 minutes): Training wrap up and questions
Allison Forrest-Laiuppa and the QA/QC Workgroup
Laboratory Data Quality Assessment and Data Usability Evaluation For Environmental Investigation and Remediation Projects

Acronym List

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>% R</td>
<td>Percent Recovery</td>
</tr>
<tr>
<td>6010</td>
<td>Determination of Trace Metals By SW-846 Method 6010 Inductively Coupled Plasma-Atomic Emission Spectrometry</td>
</tr>
<tr>
<td>6020</td>
<td>Determination of Trace Metals By SW-846 Method 6020 Inductively Coupled Plasma-Mass Spectrometry</td>
</tr>
<tr>
<td>8081</td>
<td>Pesticides by Method 8081, SW-846</td>
</tr>
<tr>
<td>8260</td>
<td>EPA SW-846 Method 8260 for determination of volatile organic compounds</td>
</tr>
<tr>
<td>8270</td>
<td>EPA SW-846 Method 8270 for determination of semivolatile organic compounds</td>
</tr>
<tr>
<td>APH</td>
<td>Air-Phase Petroleum Hydrocarbons</td>
</tr>
<tr>
<td>BAA</td>
<td>Benzo(a)anthracene</td>
</tr>
<tr>
<td>BAP</td>
<td>Benzo(a)pyrene</td>
</tr>
<tr>
<td>BCEE</td>
<td>Bis 2-chloroethylether</td>
</tr>
<tr>
<td>BEHP</td>
<td>Bis(2-ethylhexyl) phthalate</td>
</tr>
<tr>
<td>BLK</td>
<td>Blank</td>
</tr>
<tr>
<td>BKF</td>
<td>Benzo(k)fluoranthene</td>
</tr>
<tr>
<td>BRL</td>
<td>Below Reporting Limit</td>
</tr>
<tr>
<td>BTEX</td>
<td>Benzene, Toluene, Ethylbenzene, and Xylenes</td>
</tr>
<tr>
<td>°C</td>
<td>Degrees Celsius</td>
</tr>
<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensation, and Liability Act,</td>
</tr>
<tr>
<td>CC</td>
<td>Continuing Calibration</td>
</tr>
<tr>
<td>CCAL</td>
<td>Continuing Calibration</td>
</tr>
<tr>
<td>CCV</td>
<td>Continuing Calibration Verification</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CLP</td>
<td>Contractor laboratory program</td>
</tr>
<tr>
<td>COC</td>
<td>Constituent of Concern or Chain of Custody</td>
</tr>
<tr>
<td>Cmpd</td>
<td>Compound</td>
</tr>
<tr>
<td>Cr</td>
<td>Chromium</td>
</tr>
<tr>
<td>CSM</td>
<td>Conceptual Site Model</td>
</tr>
<tr>
<td>DDT</td>
<td>Dichloro-Diphenyl-Trichloroethane</td>
</tr>
<tr>
<td>DEC</td>
<td>Direct Exposure Criteria</td>
</tr>
<tr>
<td>DEEP</td>
<td>Connecticut Department of Environmental Protection</td>
</tr>
<tr>
<td>DMP</td>
<td>Dimethylphenol</td>
</tr>
<tr>
<td>DPH</td>
<td>State of Connecticut Department of Public Health</td>
</tr>
<tr>
<td>DQA</td>
<td>Data Quality Assessment</td>
</tr>
<tr>
<td>DQO</td>
<td>Data Quality Objective</td>
</tr>
<tr>
<td>DUE</td>
<td>Data Usability Evaluation</td>
</tr>
<tr>
<td>EA</td>
<td>Endrin Aldehyde</td>
</tr>
<tr>
<td>EDB</td>
<td>Ethylene Dibromide</td>
</tr>
<tr>
<td>EK</td>
<td>Endrin Ketone</td>
</tr>
<tr>
<td>ELCP</td>
<td>Environmental Laboratory Certification Program</td>
</tr>
<tr>
<td>ELUR</td>
<td>Environmental Land Use Restriction</td>
</tr>
<tr>
<td>EP</td>
<td>Environmental Professional</td>
</tr>
<tr>
<td>EPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>RCSA</td>
<td>Regulations of Connecticut State Agencies</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>RDEC</td>
<td>Residential Direct Exposure Criteria</td>
</tr>
<tr>
<td>RF</td>
<td>Response Factors</td>
</tr>
<tr>
<td>RL</td>
<td>Reporting Limit</td>
</tr>
<tr>
<td>RPD</td>
<td>Relative Percent Difference</td>
</tr>
<tr>
<td>RRF</td>
<td>Relative Response Factor</td>
</tr>
<tr>
<td>RSR</td>
<td>Criteria Numeric criteria presented in the Remediation Standard Regulations of the Regulations of Connecticut State Agencies, Sections 22a-133k-1 through 22a-133-3, inclusive.</td>
</tr>
<tr>
<td>RSRs</td>
<td>Remediation Standard Regulations of the Regulations of Connecticut State Agencies, Sections 22a-133k-1 through 22a-133-3, inclusive</td>
</tr>
<tr>
<td>Soil</td>
<td>Guidance CTDEP’s <em>Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory Determination of Volatile Organic Compounds</em>, effective March 1, 2006</td>
</tr>
<tr>
<td>SCGD</td>
<td><em>Site Characterization Guidance Document</em>, effective September 2007, Connecticut Department of Environmental Protection</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>SPLP</td>
<td>Synthetic Precipitation Leaching Procedure</td>
</tr>
<tr>
<td>SVOCs</td>
<td>Semi Volatile Organic Compounds</td>
</tr>
<tr>
<td>SWPC</td>
<td>Surface Water Protection Criteria</td>
</tr>
<tr>
<td>SW-846</td>
<td><em>Test Methods for Evaluating Solid Wastes, Physical /Chemical Methods, EPA Publication SW-846</em>, United State Environmental Protection Agency</td>
</tr>
<tr>
<td>TAT</td>
<td>Turn-Around Time</td>
</tr>
<tr>
<td>TCA</td>
<td>Trichloroethane</td>
</tr>
<tr>
<td>TCE</td>
<td>Trichloroethene</td>
</tr>
<tr>
<td>TCLP</td>
<td>Toxicity Characteristic Leaching Procedure</td>
</tr>
<tr>
<td>TICs</td>
<td>Tentatively Identified Compounds</td>
</tr>
<tr>
<td>TPH</td>
<td>Total Petroleum Hydrocarbons</td>
</tr>
<tr>
<td>UCL</td>
<td>Upper Control Limit</td>
</tr>
<tr>
<td>VOA</td>
<td>Volatile Organic Analysis</td>
</tr>
<tr>
<td>VOCs</td>
<td>Volatile Organic Compounds</td>
</tr>
<tr>
<td>VPH</td>
<td>Volatile Petroleum Hydrocarbons</td>
</tr>
<tr>
<td>YR</td>
<td>Year</td>
</tr>
</tbody>
</table>
Laboratory Data Quality Assessment and Data Usability Evaluation For Environmental Investigation and Remediation Projects

May 2017
Presented by the DEEP QA/QC Workgroup
Overview of today’s training

- Overview of Seminar, Introduction to RCPs, DQA and DUE
- Roles and responsibility for DQA/DUE process
- Quiz Time
- Break (15 minutes)
- Review of DQA
- Break (Lunch)
- DQA/DUE issues and solutions with Interactive Case Studies
- DQA/DUE Panel discussion
- Summary

Importance of Reasonable Confidence Protocols, Data Quality Assessment and Data Usability Evaluation

Peter Hill  
DEEP  
peter.hill@ct.gov

Nora Conlon  
EPA  
conlon.nora@epa.gov

Connecticut Department of Energy and Environmental Protection
## Workgroup Members

- **DEEP**
  - Remediation Division
  - Material Management and Compliance Assurance Division
- **DPH**
- **EPA**
- **LEPs/Consultants/Environmental Professionals**
- **Data Validators**
- **Laboratory personnel**
To Help Environmental Professionals

- The CT DEEP Remediation Division Laboratory QA/QC Workgroup was formed in 2004
- Reasonable Confidence Protocols (RCPs) for commonly used analytical methods were published (Nov. 2007)
- Several of Guidance Documents on RCPs and on the DQA/DUE process have been published
- DEEP and EPOC held training sessions on QA/QC and RCPs in 2005 and DQA/DUE in 2009 and today

CT DEEP Expectations Regarding Analytical Data Quality

- For samples collected on or after September 1, 2007, the DEEP expects that all analytical data used to support remediation projects be generated using the RCPs (or methodologies that contain a level of quality control and documentation adequate to evaluate the PARCCS parameters).
Analytical Data Quality

• Analytical data used for environmental investigation and remediation projects must be of a known and documented quality.
• The environmental professional has the responsibility to evaluate whether analytical data are of sufficient quality to be usable for the intended purpose.

Brief Overview of the Reasonable Confidence Protocols and the DQA/DUE Process

Paul Clark
DEEP
paul.clark@ct.gov
“PARCCS” - Data Quality Indicators

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

- PARCCS parameters can be used to examine the quality of measurements and sampling efforts

Why Were the RCPs Developed?

- SW-846 methods allow for flexibility with respect to QA/QC requirements.

- QA/QC practices vary widely by laboratory
  - Undocumented QA/QC practices.
  - Inconsistency in QA/QC deliverables.
  - Inconsistency in laboratory performance.

- RCPs based on Massachusetts Compendium of Analytical Methods.
Reasonable Confidence Protocols Key Concepts

• RCPs were developed to standardize specific performance criteria for SW-846 Methods and to standardize deliverables from laboratory analysis

• RCP methods provide analytical data of known quality

RCP Key Concepts

• If Reasonable Confidence is achieved, the environmental professional can have “Reasonable Confidence” that the laboratory has followed the enhanced QA/QC procedures for analytical methods and reporting and has described non-conformances.

• “Reasonable Confidence” will form the basis for the review of the analytical data by the environmental professional to determine if the data is acceptable for the intended purpose.
Reasonable Confidence Protocols

- Purpose – Data of Known Quality
  - LEPs MUST determine if that data of known quality meets their project objectives (Usable)
    - Alone, reasonable confidence is not enough
    - RCPs report non-conformances that are evaluated as part of the DUE

Data Quality Assessment and Data Usability Evaluation

The DQA/DUE process:

- 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 and the risk (human health, financial, environmental)
Overview of the DQA and DUE Process

Two-step process:
• 1st step is Data Quality Assessment (DQA)
  – identify and summarize QC non-conformances.
• 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 DQA will identify and summarize any quality control problems that occurred during laboratory analysis.
• The DQA should be performed throughout the course of the project.
• The DQA must be performed prior to the DUE
Data Usability Evaluation

- The DUE is an evaluation by the environmental professional of the results of the DQA to determine if the analytical data are of sufficient quality, and are usable for the intended purpose.

- A primary purpose of the DUE is to determine if any bias in the analytical results affects usability.

- The affect of the bias can be evaluated by considering different types of laboratory QC information (multiple lines of evidence).

Data Usability Evaluation

The environmental professional will also use the results of the DQA to evaluate the usability of the analytical data within the context of the project-specific objectives and the conceptual site model (CSM).

This includes considering:
- volume of data available for the site
- screening-level data
- field observations
### Types of Analytical Data

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Description</th>
<th>Data Quality Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCP Data</td>
<td>Analytical data generated using the RCPs.</td>
<td>Evaluate precision, accuracy, and sensitivity.</td>
</tr>
<tr>
<td>Non-RCP Data</td>
<td>Analytical data generated from samples collected after September 1, 2007 using a non-RCP method where there is an existing RCP method (use Reasonable Confidence Equivalency Determination Form); OR, Analytical data generated from samples collected after September 1, 2007 when no RCP method is published.</td>
<td>Demonstrate equivalency with the Reasonable Confidence Protocols - RCP Equivalency Determination Request Form required. Evaluate precision, accuracy, and sensitivity. Evaluate precision, accuracy, and sensitivity using QC data equivalent to a similar RCP method.</td>
</tr>
<tr>
<td>Pre-RCP Data</td>
<td>Analytical data generated prior to September 1, 2007 that were not generated using an RCP method.</td>
<td>Use existing QC data to evaluate precision, accuracy, and sensitivity. If precision and accuracy QC data are not available, evaluate sensitivity.</td>
</tr>
</tbody>
</table>

---

### DQA and DUE Flow Chart

1. Collect Additional Lab or Field Data Modify/Expand Investigation
2. Collect Additional Lab or Field Data Modify/Expand Investigation/Remediate
3. Analytical Data, Field Observations, Hydrogeological and Physical Data
   - DQA – Identify Non-Conformances
   - DUE - Are the Analytical Data Adequate for the Intended Purpose Based on a Review of QC Non-conformances and Information
   - YES
   - Data is Representative and of Adequate Quality to Support Environmental Professional’s Opinion
   - NO

---

Connecticut Department of Energy and Environmental Protection
Detailed look at The Reasonable Confidence Protocols

Paul Clark
DEEP
paul.clark@ct.gov
What’s In the RCPs?

- Performance criteria for laboratories regarding calibration, quality control, and reporting.
- Guidance on what the laboratory should do if analytical problems are encountered.
  - Uniform target compound lists.
  - Required laboratory deliverables.

General Description of the RCPs

- Overview of Method:
  - Reporting to lowest calibration standard.
  - General QC performance criteria.
- Sample Preparation Requirements.
- Analysis Description.
- Interferences.
Details of RCPs

• Analyte List:
  – All compounds calibrated and reported unless directed differently by the environmental professional.

• Reporting Specifications:
  – Batch MS/MSD not reported.
  – Results below RL reported as “ND”, No “J” flags.
  – Specific list of report deliverables.
  – Soils/Sediments on dry weight basis.

Details of the RCPs

• Holding Times.

• Preservation.

• Sample Container Types.
Importance of Table 1A

- Each RCP method has a Table 1a
- Summarizes the QC performance criteria

RCP Laboratory Certification Form

- Performance criteria for labs to certify the data meets RCPs with exceptions noted in narrative.
  - 7 questions
  - Requires signature
  - Can’t be altered
Laboratory Narrative

- All reports must have a narrative.
- Describe in detail all non-conformances.
- Provide all samples and analytes effected.
- Narratives should be sample-specific, as appropriate.

Laboratory Communication

- Often laboratory data does not meet intended use due to wrong compound list, incorrect method employed, reporting limits too high, etc.
- Problems can be avoided by listing project data requirements before sampling, for example in a project QAPP or work plan.

AND

- Communicating the requirements to the laboratory.
  - The Project Communication Form, or other similar document, can be used for this purpose.
What Methods Currently Have RCPs?

- 8260 Volatile Organics
- 8270 Semivolatile Organics
- 8081 Pesticides
- 8082 Polychlorinated Biphenyls (PCBs)
- 8151 Chlorinated Herbicides
- 8021 Volatile Organics
- 1311 Toxicity Characteristic Leaching Procedure (TCLP)
- 1312 Synthetic Precipitation Leaching Procedure (SPLP)
- 7196 Determination of Hexavalent Chromium
- ETPH Extractable Total Petroleum Hydrocarbons

What Methods Currently Have RCPs?

- 6010 Inductively Coupled Plasma-Atomic Emission Spectrometry
- 6020 Determination of Trace Metals
- 7470/7471 Determination of Mercury
- 7000 Series Determination of Metals
- 9010/9012/9014 Determination of Total Cyanide
- T0-13A PAHs
- TO-15 Volatile Organics
- TO-17 Volatile Organics
- VPH Volatile Petroleum Hydrocarbons
- EPH Extractable Petroleum Hydrocarbons
- APH Air-Phase Petroleum Hydrocarbons
Questions

Roles and responsibilities for DQA/DUE

Lisandro Suarez
DEEP
lee.suarez@ct.gov
Environmental Professional’s Responsibility

During Project Setup:

– QAPP/RCPs

– Project Objectives and CSM
  • Source and number of samples
  • Sampling methods, sample handling & QC requirements

– Communicate with laboratory
  • Request appropriate sampling containers, preservation, holding times, and archiving of samples
  • Request appropriate reporting limits & RCP method

– Provide a Chain of Custody and properly preserved samples within holding times
Laboratory’s Responsibility

• The Lab provides the Environmental Professional and others with:
  – Sample containers with preservative
  – Sign off on Chain of Custody
  – Laboratory Data with QA/QC information

Laboratory’s Responsibility

• The Lab provides the Environmental Professional and others with:
  – Laboratory Analysis QA/QC Certification Form
    • 7 questions with signature
  – Narrative of non-conformances
  – Answer questions when asked
Environmental Professional’s Responsibility

• Upon Receiving Data Package:
  – Review Laboratory Data Package for completeness in a timely manner
    • Review RCP Certification Form
    • Review Narrative and Chain of Custody and look for any QA/QC issues
    • Communicate with laboratory if there are any issues with the package
  – Review and evaluate the laboratory data and non-conformances in a timely manner
    • Communicate with laboratory if there are any questions

• Perform/Document DQA/DUE Process
  – Review QA/QC
    • Look beyond narrative and review laboratory data
  – Assess the quality of the data
  – Evaluate the usability of the data
  – Demonstrate and document an understanding of the quality and usability of the data for reporting purposes
Questions

Documenting the DQA/DUE Process

Allison Forrest-Laiuppa
DEEP
allison.forrest-Laiuppa@ct.gov
Common problems with documentation

- RCP method Laboratory narrative cluttered with extras, not just non-conformances
- DQA/DUE is not done at all
- DQA/DUE is not well documented
  - Is not succinct
  - Does not show review beyond lab narratives
- Incorrect use of method detection limit instead of reporting limit

Concepts of Good DQA/DUE Documentation

- Well documented DQA/DUE
- Understanding and appropriateness to the project objectives
  - Screening → Characterization → Compliance → Verification?
  - Regulatory Criteria
- Understanding of the Conceptual Site Model
  - History of site and previous environmental data
  - Representativeness and uniformity of samples collected
Concepts of Good DQA/DUE Documentation

- Discusses 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
- Includes review of Chain of Custody
- Explains possible impacts to data outside of laboratory analysis
- Is concise

Example of DQA Worksheet

DATA QUALITY ASSESSMENT WORKSHEET 2

<table>
<thead>
<tr>
<th>Sample Number(s)</th>
<th>Compound(s)</th>
<th>Quality Control Nonconformance</th>
<th>Percent Recovery</th>
<th>Relative Percent Difference</th>
<th>High/Low Bias</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOIL 7</td>
<td>AROMIC</td>
<td>LOQ/CC</td>
<td>SOV/0.041</td>
<td>L</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MERC</td>
<td>LOQ/MS/CC</td>
<td>95.0/96</td>
<td>L</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>METHANETHOL</td>
<td>LOQ/MS/CC</td>
<td>80.0/81/82/84</td>
<td>L</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ETHANOL</td>
<td>LOQ/MS/CC</td>
<td>90.0/91/92/93</td>
<td>L</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NAPHTHA</td>
<td>LOQ/MS/CC</td>
<td>90.0/91/92/93</td>
<td>L</td>
<td>PP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>METHYLCYCLOHEXANE</td>
<td>LOQ/MS/CC</td>
<td>90.0/91/92/93</td>
<td>L</td>
<td>PP</td>
<td></td>
</tr>
</tbody>
</table>

Note other QC nonconformances below (data package inspection, reasonable confidence, chain of custody, sample result, sample preservation and holding time). All notes must be included in the comments section of the worksheet.

Notes:
- Bias High: Reported result may be lower. Reporting Limit (RL) is acceptable as reported.
- Bias Low: Reported results may be higher. Reporting Limit (RL) may be higher than reported.

Example:

1. $P_{DE-30P} = 1.2 \times 9.99 \times 10^{-3} \text{ cm}^3 \text{ cm}^{-3} \text{ cm} \text{ cm}^{-3}$
Example of DUE Worksheet
(page 1)

DATA USABILITY EVALUATION WORKSHEET

Project Name: Cleaners
Laboratory: Analytical: R Us
Sample Delivery Group:
Sample Delivery Group Number: Soil 1
Date Samples Collected: 8/7/08

Describe the intended use of the data:
Confirm PCE relation at area of stained soil at location of dry cleaning filter storage.

<table>
<thead>
<tr>
<th>Nonconformities</th>
<th>Briefly Summarize DQA Nonconformities</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD RCP DELIVERABLES</td>
<td></td>
</tr>
<tr>
<td>Data Package Inspection</td>
<td></td>
</tr>
<tr>
<td>Reasonable Confidence Evaluation</td>
<td></td>
</tr>
<tr>
<td>Chain of Custody Evaluation</td>
<td></td>
</tr>
<tr>
<td>Sample Result Evaluation</td>
<td></td>
</tr>
<tr>
<td>Sample Preservation and Holding Time Evaluation</td>
<td>Samples not frozen within 48 hours – low bias</td>
</tr>
</tbody>
</table>

Example of DUE Worksheet
(page 1, continued)

<table>
<thead>
<tr>
<th>Sample Preservation and Holding Time Evaluation</th>
<th>Samples not frozen within 48 hours – low bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank Evaluation</td>
<td></td>
</tr>
<tr>
<td>Laboratory Control Samples</td>
<td>Low Bias for poorly performing compounds acetone, MEK, tetrahydrofuran, MIBK, 2-Hexane, 1,2-Dibromo-3-chloropropane. Low Bias for tetrahydrofuran and 1-Chlorotoluene</td>
</tr>
<tr>
<td>Surrogate</td>
<td></td>
</tr>
<tr>
<td>Site Specific Matrix Spiked and Matrix Spike</td>
<td>Low Bias for poorly performing compounds MEK, tetrahydrofuran, MIBK, 2-Hexane, low Bias for tetrahydrofuran and 1-Chlorotoluene</td>
</tr>
<tr>
<td>Duplicates</td>
<td></td>
</tr>
<tr>
<td>Tentatively Identified Compounds</td>
<td></td>
</tr>
<tr>
<td>Other QC Data</td>
<td></td>
</tr>
<tr>
<td>Continuing Calibration Blank or Initial Calibration Blank Evaluation</td>
<td>Low Bias for poorly performing compounds acetone, MEK, MIBK, 2-Hexane, Low Bias for tetrahydrofuran and 1-Chlorotoluene</td>
</tr>
<tr>
<td>Methanol standards in blank 27 ppm in sample at 28 ppm</td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td>Tetrachloroethane detected in sample at 400 μg/kg, GAPHE is 0.1 mg/kg. Site is a historic drycleaners site</td>
</tr>
</tbody>
</table>
Example of DUE Worksheet (page 2)

DATA USABILITY EVALUATION WORKSHEET (CONTINUED)

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.

Because the sample was not frozen/preserved within 48 hours of collection, the sample exhibits low bias. However, tetrachloroethene detected in sample at 400 μg/kg well above GA PMC of 100 μg/kg.

Nonconformances related to MS/MCDs, LCS and CC are not related to substances that are constituents of concern at the release area and in most cases are poorly performing compounds.

Methylene chloride was found in the sample and a blank. Application of the 10x rule indicates that the methylene chloride found in the sample is related to laboratory contamination.

Groundwater investigation of this release area indicates the presence of tetrachloroethene.

The analytical data set of adequate quality and of sufficient accuracy, precision, and sensitivity to confirm that remediation of this release area is required. Further investigation will be conducted to characterize the extent this release area.

Example of a DQA/DUE Text Summary

One soil was collected at the Cleaners property at 967 Breadbaker Lane, Nowhere CT and submitted to a state-certified analytical laboratory for volatile organic compounds (VOCs) using the Reasonable Confidence Protocol (RCP) Method 8260. This sample was collected to confirm the results of a previous investigation that concluded that a PCE release area is located near a location used for dry cleaning filter storage. The site was used as a dry cleaners for at least 40 years from 1950 to 1990.

A data quality assessment and data usability evaluation was performed for data generated in accordance with CT DEEP guidance and noted the following quality control nonconformances.

Methylene chloride was found in a laboratory blank and in a sample at a concentration less than the class GA Groundwater Protection Criteria (GAPMC) as a result of laboratory contamination.

Continuing Calibration, Laboratory Control Samples, and Matrix Spike/Matrix Spike Duplicates exhibited bias for poor performing compounds and several other compounds that are not constituents of concern at the release area.

The sample was not frozen within 48 hours of collection and exhibits low bias for VOCs. Tetrachloroethene detected in sample at 400 μg/kg well above GA PMC of 100 ug/kg.

Groundwater data indicates that a PCE release has occurred at the site. Based on the above findings from the DQA and DUE, the analytical data is adequate quality and of sufficient accuracy, precision, and sensitivity to confirm that remediation of this release area is required. Further investigation will be conducted to characterize the extent this release area. DQA and DUE worksheets are included in the appendix to this document.
Reports should include

- Discussion of your site decision and data usability statement
- Laboratory Data and Narratives
- RCP Analysis and RCP QA/QC Certification Form
- Chain of Custody

Reports should include

- DQA/DUE Worksheets or documentation of thought process
- Summary of the evaluation all QA/QC issues and laboratory non-conformances
- Any other pertinent information
Questions

Quiz Time

Multiple Choice
A. Yes
B. No
C. It Depends

Rebecca Merz
Eurofins Spectrum Analytical, Inc.
RebeccaMerz@EurofinsUS.com
Does the laboratory need to know that your project falls under the CT RCP program and this form should be included with your report?

Surrogates Outside Criteria

LEP Joe submitted two 1L ambers for 8270 analysis for standard TAT and notes SWPC criteria needs to be achieved. Acenaphthene is the COC (SWPC = 0.3 ug/L).

When you receive your lab report the narrative states that the surrogate recovery for this sample is outside of established control limits due to a sample matrix effect. The lab has re-extracted and confirmed matrix interference, however, the re-extraction was performed outside holding time.

Acenaphthene reportable concentration (original) 0.26 ug/L (re-extract) 0.29 ug/L
Chain of Custody 101

Does your chain need to match your labels for the following?

- sample ID, collection, date, time, and project name/site location?

Do you need to be specific with your methods?

- Metals...

If using container caps to write information should the same information must be on the label?

---

Connecticut Department of Energy and Environmental Protection

---

Laboratory Blank Contamination associated to Metals samples

<table>
<thead>
<tr>
<th>Lab ID</th>
<th>Client ID</th>
<th>Method</th>
<th>Compound</th>
<th>QC Qater</th>
<th>BLK or Blank Contaminant</th>
<th>PPD</th>
<th>Bias</th>
<th>Result</th>
<th>Units</th>
<th>SVPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABCDE-01</td>
<td>SW42</td>
<td>SW846 6020</td>
<td>Arsenic</td>
<td>BLX</td>
<td>1.1</td>
<td>-</td>
<td>high</td>
<td>12</td>
<td>µg/L</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Table 1A Specific QA/QC Requirements and Performance Standards for Method 6020

| Method Blocks | Laboratory Contamination Evaluations | 1) Departed every 20 or every batch, whichever is greater. If no digestion, 1CB = blank | 2) Matrix specific and matrix matched | 3) Target analyte must be BLX | YES | Locate source of contamination and correct problem. Recalibrate method blank. Resubmit samples unless all analytes concentration >10x method blank level | Report non-conformances as soon as practicable |

CASE NARRATIVE:

**SW846 6020A**

-ArSENIC

The method blank contains analyte at a concentration above the MRL; however, concentration is less than 10% of the sample result, which is negligible according to method criteria.

Connecticut Department of Energy and Environmental Protection
• The result reported for PCE is flagged "E" or estimated because the result was above the calibration range of the instrument. The lab performed a dilution.
  – Should both sets of data be included in the lab report?
  – Which result should be used for ND concentrations?

LCS/ LCSD Low Bias
Barium percent recoveries (83/79) are outside individual acceptance criteria 85-115. Results of the following samples are considered to have a potentially low bias.
• Given the example below what are some DUE considerations?
What is wrong with this VOC Sample? What potential issues might the lab have during analysis?

15 Minute Break
Data Quality Assessment (DQA)

Jim Occhialini
Alpha Analytical
jocchialini@alphalab.com

Connecticut Department of Energy and Environmental Protection

Topics for Discussion

• Overview
• Quality
• Data Quality Assessment (DQA)
• Data Usability Evaluation (DUE)
• Data Management
• Lab Report Review
Why is Data Usability Important??

It’s all about managing uncertainty…

and incorporating that uncertainty into your decision making
Relationship Between Risk Tolerance & Uncertainty

• Do you evaluate all your data the same way?
  – Final clean up verification samples vs. initial site screening?

• Level of scrutiny applied to laboratory data commensurate with what it will be used for
  – Risk assessment?
  – Locate “hot spots”?

Sources of Uncertainty

Field / Sampling + Lab = Total Uncertainty

contaminant distribution / homogeneity
sample location rationale
sampling method
preservation & handling
calibration
preparation
performance
QA program
  - QUALITATIVE
  + QUANTITATIVE
Regulatory Approaches to Managing Uncertainty

- EPA
  - Program wide approach
    - CERCLA ("superfund")
      - Contractor laboratory program (CLP) - **PREScriptive**
  - Project specific approach
    - RCRA
      - SW-846 **GUIDANCE**
      - Quality Assurance Project Plans (QAPPs)
  - Data Quality Objectives (DQOs) for RI/FS ~1984

- States
  - Program wide approach
    - CT Reasonable Confidence Protocols (RCP) ~2006
      - RCP DQA/DUE
    - MA Compendium of Analytical Methods (CAM) ~2003
      - MCP REDUA 2007
    - NJ DEP Technical Guidance  4/2014

Connecticut Department of Energy and Environmental Protection

---

**Wait a minute...aren’t labs CERTIFIED?**
CERTIFIED MEANS:

YES, you’re qualified…

Certification is provided through a formal process of application, audit and approval of a laboratories' quality system. Certification must be renewed annually.

Comprehensive, well thought-out process, based on approval of a “laboratories’ quality system”…

…so lab certification means everything is in place to produce “data of known quality”

Doesn’t mean that all data generated by the lab is of known quality

…or the data in your report
LABORATORY QA/QC

OVERVIEW
**QA & QC Separate Functions**

- **Quality Control** — (2 components)
  1. "QC infrastructure"
  2. Continuing monitoring / documenting data quality
     - Internal lab system control & project-specific DQI info

- **Quality Assurance**
  - Assures the QC is performed, “enforcer”
  - Systematic & performance audits
    - Does the lab perform internal audits?
      - Follow up on corrective actions?

**Quality System**

---

"Reasonable Confidence Process"…

- **Data Quality Assessment (DQA)**
  - Identify non-conformances

- **Data Usability Evaluation (DUE)**
  - Impact of non-conformances on your use of the data
...so what do we mean by “data quality”?

The degree of qualitative & quantitative uncertainty that exists in the data set

How Do You Evaluate Data Quality?

PARCCS
What is data of known quality???

Known PARCCs

From the laboratory perspective
- The accuracy, precision and sensitivity is ascertainable

What it isn’t necessarily...
How Do You Get Data of Known Quality

Level of uncertainty is known... HOW?

1. Data generated & reported in accordance with an “RCP” protocol

2. Data generated & reported with a full data deliverables package
   Incorporating a comprehensive QAPP & complete data validation

3. Lab followed SPECIFIC, WELL DOCUMENTED methods
   With detailed performance, QC requirements and corrective actions

---

Data Quality Assessment - Starting the Process

- RCP compliant data and...
  - QUESTION 4 “Were all QA/QC performance criteria specified in the DEEP Reasonable Confidence Protocol documents achieved?” “YES”

- Further data quality assessment may not be necessary
  - LEP should still review the data
  - Known quality data, WITH NO NON-CONFORMANCES

- Data usable as is for all applications
  - Still need to review reporting limits versus regulatory criteria
There are usually some non-conformances...

Document them as part of the DQA

Data Quality Assessment

• Where do I start?
  – LAB NARRATIVE (list of non-conformances)
    • Includes all issues of significance to data user: method performance problems, QA/QC outliers, etc.
  – Lab report BATCH QC summary data section
  – Lab report SAMPLE SPECIFIC QC data pages

• What do I need to know?
  – Data quality indicators (info for usability purposes)
    • Accuracy
    • Precision
    • Sensitivity (reporting limits)
Accuracy – Evaluation of Bias that Exists in the Measurement System

- Is there bias?
  - Lab measurement system in control?
  - Sample-specific interferences?

**Spike recovery:**
\[
\frac{MV}{TV} \times 100 = \%R
\]

Where MV = Measured Value & TV = True value

Data quality indicators - measurement tool:
blanks & spikes

%R can indicate positive or negative bias

---

Accuracy - Lab Data Quality Indicators

**Lab Batch QC**

- Lab control sample (LCS) *if done in duplicate* ... (LCS / LCSD)
  - Baseline accuracy determination, entire target analyte list
  - Potential POSITIVE or NEGATIVE bias

- Matrix spike/matrix spike duplicate (MS/MSD)
  - Same as LCS/LCSD w/spike added to actual sample

- Laboratory method blank
  - False positive indicator, **potential POSITIVE bias**

**Sample Specific QC**

- Surrogate Spikes
Accuracy – Additional Data Quality Indicators

Sample Specific QC
• **Surrogate Spikes**
  – Chemically similar subset of analytes
• Hold times (sample & parameter specific QC element)
  – False negative indicator, **potential NEGATIVE bias**

Field QC
• Matrix spike/matrix spike duplicate (MS/MSD) *
  • Same as LCS/LCSD w/spike added to actual sample
• Field, trip, and/or equipment blank (field QC samples)
  – False positive indicator, **potential POSITIVE bias**

Evaluating Accuracy

<table>
<thead>
<tr>
<th>Example %R</th>
<th>Example Acceptance Criteria</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>70 – 130</td>
<td>Negative bias</td>
</tr>
<tr>
<td>147</td>
<td>70 – 130</td>
<td>Positive bias</td>
</tr>
</tbody>
</table>

Where does the criteria come from? What's in your report?

*Bias can be positive or negative, expressed as %R*

• %R used for surrogates, LCS/LCSD & MS/MSD
  – *Don’t do the math!*
### Interpreting Accuracy Bias

<table>
<thead>
<tr>
<th>Result</th>
<th>Spike %R</th>
<th>Action Level</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>22%</td>
<td>55</td>
<td>75 – 110 %</td>
</tr>
<tr>
<td>50</td>
<td>47%</td>
<td>1</td>
<td>75 – 110 %</td>
</tr>
</tbody>
</table>

**Interpretation:**
- Positive / negative bias
- **vs.** Relationship of data point to the action level
- **vs.** Specific use of the data

---

### VOC Surrogate Spike Data

<table>
<thead>
<tr>
<th>Surrogate</th>
<th>% Recovery</th>
<th>Qualifier</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichloroethane-d4</td>
<td>25</td>
<td></td>
<td>70-130</td>
</tr>
<tr>
<td>Toluene-d8</td>
<td>102</td>
<td></td>
<td>70-130</td>
</tr>
<tr>
<td>4-Bromofluorobenzene</td>
<td>104</td>
<td></td>
<td>70-130</td>
</tr>
<tr>
<td>Dibromofluoromethane</td>
<td>96</td>
<td></td>
<td>70-130</td>
</tr>
</tbody>
</table>

Reported for each sample at the end of the target compound list

Surrogate %R does not automatically indicate that a QC issue exists for a specific compound – MS can be used to evaluate performance of a specific compound
Precision – Expression of Reproducibility & Variability

• How reproducible is the lab measurement system?
• Sample homogeneity?

Precision measurement tool: replicate analyses
Evaluated using relative percent difference (RPD)

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

% RPD = the absolute value of the range divided by the mean times 100

Precision - Expression of Reproducibility & Variability

Laboratory generated precision information:
• (LCS / LCSD)
  – Two analyses → results compared (%RPD) for precision
• Laboratory batch duplicates

Field generated precision information:
• Field duplicates, co-located samples, MS/MSD
  – Submit “blind”, calculate RPD
Evaluating Precision

<table>
<thead>
<tr>
<th>Example RPD</th>
<th>Example Acceptance Criteria (%RPD Upper Limit)</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>25</td>
<td>Precision within acceptable range</td>
</tr>
<tr>
<td>35</td>
<td>25</td>
<td>Precision outside acceptable range</td>
</tr>
</tbody>
</table>

- %RPD acceptance criteria represents an upper limit
  - Greater the RPD, more variability (less precision)
- %RPD used for LCS/LCSD, MS/MSD, lab/field duplicates

Interpreting Precision Information

- Sources of variability
  1. measurement system performance (lab & field) reproducibility issues
  2. sample non-homogeneity, media variability (field) representativeness issues

- Evaluating replicate non-agreement
  - Field / lab duplicate samples  \(\text{conservative, use > result}\)
### VOC LCS / LCSD Data

#### Lab Control Sample Analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>LCS % Recovery</th>
<th>Goal</th>
<th>LCSD % Recovery</th>
<th>Goal</th>
<th>% Recovery Limits</th>
<th>RPD</th>
<th>Goal</th>
<th>RPD Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile Organics by GC/MS - Westborough Lab</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n-Heptane</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n-Hexane</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n-Pentane</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isopentane</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,1-Dichloroethane</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diethyl Ether</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diethyl Ketone</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diisopropyl Ether</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetone</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butylacetate</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decane</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasoline</td>
<td>96</td>
<td>96</td>
<td>70-100</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reported result:** "9"  
**Highest allowable variability (25% RPD) of associated LCS/LCSD**

#### IF LCS %R indicated LOW BIAS

- **accuracy (biased low)**
- **precision**

**If LCS/LCSD RPD was 43%**

---

**Connecticut Department of Energy and Environmental Protection**
Sample Concentration: 17 PPM

Sample Response: 17500

Elevated RLs due to dilutions:
- High target (or non-target) compound concentration
- Difficult sample matrix, spikes diluted out?

Preparative Analysis

Sample Extraction
- “winnowing down” process
  - isolate (extract) & concentrate
- exploit solubility difference
- primary source of method sensitivity and...method performance problems

1 mg/L (instrument RL)
1000x concentration factor
= 1 ug/L method sensitivity
So You’ve Documented the “Non-Cons”…

Is the data usable? Do the DUE
Data Collection Process

Objective: Collect Data of Known Quality
Suitable for its Intended Use

• Planning – project set up
  • Involve all data users
  • Field staging / lab set up

• Execution
  • Collect & analyze samples

• Data management project follow up
  • DQA / DUE
  • Meet my needs? Is it usable?

You’ve Completed the DQA

Are the Data Usable?

Focus...

• Why did the report get a “NO” on Question 4 (RCP)?
• What else did your DQA find?
  – Isolate analysis
    • Isolate analytes
  – This is the data that needs to be evaluated

• Everything else is OK to use “as is”…
  – Still need sensitivity evaluation
Data Usability Evaluation Process

- Completed DQA
  - Summary of non-conformances

**DUE – what does it mean for my project?**

- Evaluate relevancy
  - Contaminant of concern? Sample location? Significance?
    - Bias: +, - or indeterminate?
    - Relationship of result to regulatory criteria
- Incorporate uncertainty into decision-making
  - Does this non-conformance impact my use of the data?
  - **RISK TOLERANCE**

---

**DUE: Additional Considerations**

- Multiple lines of evidence
  - Batch QC DQIs / sample specific DQIs
    - Additive or contradictory effect?
  - Bring in info beyond current lab report
    - Historical data, field data, other samples, CSM, etc.

- Trade offs
  - Non-conformance severity (17% R or 70% R)
    - Importance of this data point / risk tolerance?
  - Is the non-conformance tempered by facts?
    - (dilution, co-elution, obvious sample matrix issues…)

Connecticut Department of Energy and Environmental Protection
Evaluating Significant QA/QC Variances

- Excessive QC non-conformances
  - Rejected data
  - Intended use & risk tolerance dependent
  - Would require substantial justification

So...Is the Data Usable?

Can you justify it?

Can you make the case for using qualified results for your project application?
Managing Usability Information

• Summarize your data qualifications
  – Table summary (Exception Report NON-CONFORMANCES?)
  – Integrate into project data base

• Use data usability -qualified data for all decision making

• Reminder
  – you really should have an understanding of data limitations ongoing as decisions are made

APPENDIX A-2
DATA Usability EVALUATION WORKSHEET

<table>
<thead>
<tr>
<th>Nonconformance DQA Review Element</th>
<th>Briefly Summarize DQA Nonconformance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory Report Inspection</td>
<td></td>
</tr>
<tr>
<td>Reagent and Standards Evaluation</td>
<td></td>
</tr>
<tr>
<td>Chain of Custody Evaluation</td>
<td></td>
</tr>
<tr>
<td>Sample Receipt Evaluation</td>
<td></td>
</tr>
<tr>
<td>Sample Preservation and Storing Time Evaluation</td>
<td></td>
</tr>
<tr>
<td>Blank Evaluation</td>
<td></td>
</tr>
<tr>
<td>Laboratory Control Samples</td>
<td></td>
</tr>
<tr>
<td>Surrogate</td>
<td></td>
</tr>
<tr>
<td>Analyte Matter Specific Tests and Controls</td>
<td>LLC Detection</td>
</tr>
<tr>
<td>Traceable Identifiable Compounds</td>
<td></td>
</tr>
<tr>
<td>Other QC data</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix D-3

#### Data Quality Assessment Worksheet 2

<table>
<thead>
<tr>
<th>Sample Number(s)</th>
<th>Compound(s)</th>
<th>Quality Control Nonconformance</th>
<th>Percent Recovery</th>
<th>Relative Percent Difference</th>
<th>High/Low Bias</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Bias High: Reported result may be lower. Reporting Limit (RL) is acceptable as reported.
- Bias Low: Reported results may be higher. Reporting Limit (RL) may be higher than reported.

*Note other QC nonconformities below (data package inspection, recoverable confidence, chain of custody, sample result, sample preservation and holding time evaluations).*

---

Connecticut Department of Energy and Environmental Protection
APPENDIX C
QUALITY CONTROL INFORMATION TO BE EVALUATED DURING DQA AND DUEs

CTDEP expects that the environmental professional will evaluate all laboratory reported QC information and nonconformances in accordance with this guidance. Nonconformances that are found may be noted on the DQA Worksheets found in Appendix D of this document.

The information below summarizes standard, required deliverables required by the RCPs. In addition, the RCPs require additional QC information to be reported. The standard and non-standard RCP deliverables are presented in Table 1A of each of the RCP methods. This summary does not supersede the QC deliverables required by the respective RCP methods. The QC information that must be reviewed during the DQA by the environmental professional includes, but is not limited to the following:

STANDARD RCP DELIVERABLES
Laboratory Report Inspection
Goals: Determine that all laboratory deliverables are provided and complete.
Tasks:
• Review the laboratory report to determine that the following items are present for all sample batches:
  o Reasonable Confidence Protocol Laboratory Certification Form (LCF);
  o Narrative identifying QC nonconformances;
  o Analytical results;
  o Chain of Custody Form; and
  o Quality control results, including but not limited to:
    • Method Blanks;
    • Laboratory Control Samples (LCS);
    • MS/MSD (when required);
    • Surrogate(s) (as appropriate for methods); and
    • Other QC results and information provided in the laboratory report.
Laboratory Report Review

- You are the LEP of record
- Site history
- Currently truck maintenance facility
- Post-remediation analytical data
- DQA/DUE to support decision-making
- Review RCP certification form
- Review non-conformance narratives & QC information
  - Accuracy, Precision & Sensitivity

Results, reporting limits
COCs, Reg Criteria

QC “non-cons”
Data use

good fit?

Usable?

Connecticut Department of Energy and Environmental Protection
CONCEPT

REVIEW

DQA: Find non-conformances
DUE: Evaluate impact of non-conformances

• What are we looking for?
  – “No” answers on Questionnaire
  – Narrative comments
  – QC outliers
    • QC summary sections
    • Data pages for sample-specific QC

Triage – what’s important?
  • COC...or not?
  • Sample location...significant?
  • Other project specific driver...

Connecticut Department of Energy and Environmental Protection
RCP Summary Questionnaire

Any “No”s?

QUESTION 4: NO
QUESTION 5b: NO

Question 5b:

Were these reporting limits met? NO

• Why the “NO” answer?
  – Check the narrative, use data table

• 1,2-Dibromo-3-chloropropane
  – Run by Method 8260 (RL 2.5 ug/L)
    • Alternative Polluting Substance Criteria 0.2 ug/L
  – Alternative methods not requested
  • Not contaminant of concern at this site
Question 4:
Were all QA/QC performance criteria specified in the DEEP Reasonable Confidence Protocol documents achieved?

**NO (not a big surprise)**

- For most projects, you should not expect a “YES” to this question...
- Proceed to narrative

---

**VOC Surrogate Spike %R Non-Conformance**

Sample-specific QC (page 14)

(only applies to Sample L1704848-02)

<table>
<thead>
<tr>
<th>Surrogate spike Compound</th>
<th>% Recovery</th>
<th>Acceptance Criteria (%R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-dichloroethane-d4</td>
<td>57%</td>
<td>70 – 130%</td>
</tr>
</tbody>
</table>

Sample was re-run (pages 15 - 17) similar surrogate performance (54%R)
### VOC Sample L1704848-02

**Low Surrogate %R**

- Data usability impact?
  - Negative bias
    - Actual results could be greater than reported value
      - Data reported could be less conservative

- Implications
  - This sample only, applies to entire TCL
  - Re-run confirms sample-specific matrix effect
  - BTEX hits, rest of TCL ND (both runs)
    - SERIOUS ISSUE, BTEX COCs w/ negative bias indicated
      - DUE implications

### VOC LCS / LCSD Non-Conformances

LCS / LCSD (over-recoveries - compound specific)

- Analytical Batch QC *(applies to all samples run in this batch)*

<table>
<thead>
<tr>
<th>Compound</th>
<th>LCS %R</th>
<th>LCSD %R</th>
<th>Acceptance Criteria %R</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-methyl-2-pentanone</td>
<td>155</td>
<td>155</td>
<td>70 – 130</td>
</tr>
<tr>
<td>2-butanone</td>
<td>153</td>
<td>153</td>
<td>70 – 130</td>
</tr>
<tr>
<td>2-hexanone</td>
<td>154</td>
<td>154</td>
<td>70 – 130</td>
</tr>
</tbody>
</table>
VOC LCS / LCSD Non-Conformances (over-recoveries)

- Data usability impact?
  - Batch QC: Applies to all samples run in this batch
  - **Positive bias scenario**
    - Actual result could be less than reported value
      - Data for these compounds is **more conservative**
- Implications?
  - ND reported for each compound, w/positive bias
  - Cmpds are not contaminants of concern
  - Cmpds are considered poor performers
    - **NO ISSUE, no DUE implications**

VOC LCS/LCSD Non-Conformances (under-recoveries – compound specific)

Analytical Batch QC (applies to all samples run in this batch)

<table>
<thead>
<tr>
<th>Compound</th>
<th>LCS %R</th>
<th>LCSD %R</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>47</td>
<td>98</td>
<td>70 – 130 RPD 70%</td>
</tr>
</tbody>
</table>

(Page 24)
LCS / LCSD Recoveries (benzene under-recovery)

- Data usability impact?
  - Batch QC: Applies to all samples run in this batch
  - Negative bias
    - Actual result could be greater than reported value
    - Data reported could be less conservative

- Implications?
  - Cmpd is a contaminant of concern
  - Multiple lines of evidence supporting negative bias for sample -02 Benzene result {surrogate & LCS}
    - SERIOUS ISSUE, Benzene a COC w/ negative bias indicated
      - DUE implications

Connecticut Department of Energy and Environmental Protection
### VOC DQA Non-Conformances of Concern

<table>
<thead>
<tr>
<th>Sample ID or QC element</th>
<th>CMPD</th>
<th>Initial</th>
<th>Re-Analysis</th>
<th>Decision / rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCS %R</td>
<td>Benzene</td>
<td>47%</td>
<td>NA</td>
<td>Benzene low bias, applies to both samples</td>
</tr>
<tr>
<td>L1704848-02</td>
<td>All cmpds</td>
<td>57%</td>
<td>54%</td>
<td>Low %R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All TCL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Probable low bias</td>
</tr>
<tr>
<td>L1704848-01</td>
<td>Benzene</td>
<td>&lt;0.5 ug/L</td>
<td>NA</td>
<td>Benzene LCS low %R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Probable low bias</td>
</tr>
<tr>
<td>L1704848-02</td>
<td>Benzene</td>
<td>0.7 ug/L</td>
<td>NA</td>
<td>Benzene LCS low %R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Probable low bias</td>
</tr>
<tr>
<td>L1704848-02</td>
<td>Benzene</td>
<td>0.7 ug/L</td>
<td>0.7 ug/L</td>
<td>Surrogate low %R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Probable low bias, all cmpds</td>
</tr>
<tr>
<td>L1704848-02</td>
<td>All cmpds</td>
<td>All “hits” &amp; NDs</td>
<td>All “hits” &amp; NDs</td>
<td>Surrogate low %R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Probable low bias, all cmpds</td>
</tr>
</tbody>
</table>

---

### VOC Data Usability Evaluation (DUE) Summary

- Sample L1704848-02 initial & re-analysis
  - Both 0.7 ug/l benzene, GW Quality Criteria: 1.0 ug/L
    - MLE indicate negative bias (surrogate, LCS)
      - Both results just below reg criteria
      - Action?

- Sample L1704848-01
  - Benzene ND at 0.5 ug/L
    - With low bias indicated (LCS)
      - is it really ND?

- Samples -01 & -02 positive bias
  - 4-methyl-2-pentanone, 2-butanone, 2-hexanone
  - Positive bias w/all NDs, not COCs, No data usability impact
SVOC Non-Conformances (Page 50-51)

**LCS / LCSD Recoveries and RPDs DQA Review**

Analytical Batch QC (applies to all samples run in this batch)

<table>
<thead>
<tr>
<th>Compound</th>
<th>LCS %R</th>
<th>LCSD %R</th>
<th>%RPD</th>
<th>%R Acceptance Criteria</th>
<th>RPD Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(a)anthracene</td>
<td>33</td>
<td>41</td>
<td>22</td>
<td>40 – 140</td>
<td>30%</td>
</tr>
<tr>
<td>2,4-Dimethylphenol</td>
<td>33</td>
<td>27</td>
<td>20</td>
<td>30 – 130</td>
<td>30%</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>30</td>
<td>40</td>
<td>29</td>
<td>40 – 140</td>
<td>30%</td>
</tr>
</tbody>
</table>

**SVOC LCS / LCSD Recoveries**

**DUE Thought Process**

- **Data usability impact?**
  - Negative bias
    - Actual results could be greater than reported value
    - Data reported could be less conservative

- **Implications?**
  - All 3 cmpds “slightly below” acceptable %R range
    - SERIOUS ISSUE (?), COCs w/ negative bias indicated
      - DUE implications
    - Need to evaluate results in relation to action levels
SVOC DUE Thought Process  

- PAHs - benzo(a)anthracene, benzo(a)pyrene
  - “OUT”: Low bias (LCS)
    - Impacts all 3 samples
  - “IN”: LCSD, MS/MSD, surrogates, blank acceptable & FD
  - Sample -03 ND (<110 / 140 ug/kg)

- FD results
  - BAA: 200 / 180 hit versus 1,000 regulatory criteria
    - OK?
  - BAP: 500 / 470 hit versus 1,000 regulatory criteria
    - OK?

- CONTEXT? COC, use of data, “body of work”, EPC?

SVOC DUE Thought Process  

(multiple lines of evidence)

- Dimethylphenol
  - “OUT”: Low bias (LCS, “just out”)
    - Impacts all 3 samples
  - “IN”: LCS, MS / MSD, surrogates, blank, FD acceptable

- DMP: all 3 samples <180 ND versus 2,800. regulatory criteria
  - OK?
SVOC MS/MSD Non-Conformances

(DQA summary)

- Analytical Batch QC (but applies to sample -01 only)
- (Page 55 - 58)

<table>
<thead>
<tr>
<th>Compound</th>
<th>MS %R</th>
<th>MSD %R</th>
<th>%RPD</th>
<th>%R Acceptance Criteria</th>
<th>RPD Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bis(2chloroethyl)ether</td>
<td>38</td>
<td>48</td>
<td>23</td>
<td>40 – 140</td>
<td>30%</td>
</tr>
<tr>
<td>Benzo(k)fluoranthene</td>
<td>38</td>
<td>48</td>
<td>23</td>
<td>40 – 140</td>
<td>30%</td>
</tr>
<tr>
<td>Pentachlorophenol</td>
<td>20</td>
<td>32</td>
<td>46</td>
<td>30 – 130</td>
<td>30%</td>
</tr>
</tbody>
</table>

SVOC MS/MSD Data

DUE Thought Process... Action?

- Data usability impact?
  - Negative bias
    - Actual results could be greater than reported value
    - Data reported could be less conservative

- Implications?
  - Similar situation as with LCS data
    - COCs w/ negative bias indicated, DUE implications
    - Need to evaluate results in relation to action levels
SVOC Data Usability Evaluation Summary

(DUE multiple lines of evidence)

• PAHs - Benzo(k)fluoranthene
  – “OUT”: Low bias (MS/MSD, “just out”)
  – “IN”: LCS / LCSD, surrogates, blank acceptable & FD
    – -03 ND (<110 ug/kg), -04 (0.12 & ND) vs 1,000 ug/kg criteria
  – FD identical result
    • BKF: [120 hit / <110] versus 1,000. regulatory criteria
      – OK?
    – CONTEXT? COC, use of data, “body of work”, EPC?

• Bis 2-chloroethylether
  – “OUT”: Low bias (MS/MSD, “just out”)
    • soil samples all ND (<180)
  – “IN”: LCS / LCSD, surrogates, blank acceptable & FD
    • FD identical result (<180)
    • BCEE: <180 result versus 1,000 regulatory criteria
      – OK?
SVOC Data Usability Evaluation Summary

*(DUE multiple lines of evidence)*

- Pentachlorophenol
  - "OUT": Low bias (MS/MSD, "way out"), FD %RPD
  - "IN": LCS / LCSD, surrogates, blank acceptable
    - #-03: <140 hit versus 1,000 regulatory criteria (low MS)
    - #s-04/FD: 700 / 2,200 versus regulatory criteria

-04 & -05 FDs? 103% RPD

SVOC DUE Summary

<table>
<thead>
<tr>
<th>CMPD</th>
<th>-03 mg/Kg</th>
<th>-04 (FD -04)</th>
<th>-05 Criteria Mg/Kg</th>
<th>LCS/LCSD</th>
<th>MS/MSD (-03)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzo(a)anthracene</td>
<td>&lt;0.110</td>
<td>0.200</td>
<td>0.180</td>
<td>1.0</td>
<td>low bias</td>
</tr>
<tr>
<td>2,4-Dimethylphenol</td>
<td>&lt;0.180</td>
<td>&lt;0.180</td>
<td>0.180</td>
<td>2.8</td>
<td>low bias</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>&lt;0.14</td>
<td>0.500</td>
<td>0.470</td>
<td>1.0</td>
<td>low bias</td>
</tr>
<tr>
<td>Bis(2chloroethyl)ether</td>
<td>&lt;0.186</td>
<td>&lt;0.180</td>
<td>&lt;0.180</td>
<td>1.0</td>
<td>low bias</td>
</tr>
<tr>
<td>Benzo(k)fluoranthene</td>
<td>&lt;0.110</td>
<td>0.120</td>
<td>&lt;0.110</td>
<td>1.0</td>
<td>Low bias</td>
</tr>
<tr>
<td>Pentachlorophenol</td>
<td>&lt;0.140</td>
<td>0.700</td>
<td>2.2</td>
<td>1</td>
<td>OK</td>
</tr>
</tbody>
</table>

Connecticut Department of Energy and Environmental Protection
EPH Non-Conformances *(pages 62 - 63)*

- EPH COD extraction surrogate
  - Sample-specific QC (L1704848-03)

<table>
<thead>
<tr>
<th>Surrogate spike Compound</th>
<th>% Recovery (%R)</th>
<th>Acceptance Criteria (%R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloro-octadecane</td>
<td>248%</td>
<td>40 - 140%</td>
</tr>
</tbody>
</table>

Extraction surrogate high – seriousness?

- Chloro-octadecane - monitors extraction performance
  - “of aliphatic extraction only”

- **Positive bias**
  - Actual results could be less than reported value
  - Data reported could be more *conservative*

**WHY IS THE SURROGATE RECOVERY SO HIGH?**
Chromatographic interference, co-elution?

**COD Surrogate**

Chromatogram should be included with report

---

**EPH DUE Summary**

*multiple lines of evidence*

- EPH
  - "OUT": COD surrogate high bias ("co-elution")
  - "IN": LCS / LCSD, OTP surrogate, MS/MSD, & blank
  - Field duplicate – 57% RPD
  - TPH (sample -03): 10, 14, 9 range hits (20 mg/Kg criteria)
    - If any bias present, it would be high bias
      - Actual result less than reported value
    - OK?
### PCB Non-Conformances

**Sample -03 TCMX surrogate**

- Sample specific QC

<table>
<thead>
<tr>
<th>Surrogate</th>
<th>Col 1 % R</th>
<th>Col 2 % R</th>
<th>% R Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4,5,6-tetrachloro-m-xylene</td>
<td>8</td>
<td>9</td>
<td>30 – 150</td>
</tr>
<tr>
<td>Decachlorobiphenyl</td>
<td>33</td>
<td>37</td>
<td>30 – 150</td>
</tr>
</tbody>
</table>

### PCB DUE Summary

*(multiple lines of evidence)*

- Sample -03, contradictory MLE
  - "OUT": TCMX surrogate
  - "IN": LCS/LCSD, MS/MSD, DCB surrogate

- Guidance: MS %R can overrule surrogate %R
  - *Sample -specific*
  - Always a judgment call

- But in this case... with surrogate %R <10%
Surrogate recovery <10%, a’’ significant QA/QC variance (Appendix E)

Data can be deemed unusable

Dependent on intended use of data,

Given our clean up verification application...

For training purposes only (i.e. “no sample left”) in real life laboratory would/should have re-run or otherwise notify you if that wasn’t possible

Rejection means it never happened...

PCB 1260 Field Duplicate Data

<table>
<thead>
<tr>
<th></th>
<th>-04</th>
<th>-05</th>
<th>RPD</th>
<th>% RPD Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>740</td>
<td>1230</td>
<td>49%</td>
<td>30% Not to exceed</td>
</tr>
</tbody>
</table>

FDs indicate poor precision – is it laboratory performance, sampling technique or sample non-homogeneity?

All other DQIs acceptable for these samples,

from a MLE perspective you could “over look” FD %RPD performance, EXCEPT...
## PCB Data Usability Evaluation Summary

<table>
<thead>
<tr>
<th>Sample ID or QC element</th>
<th>Result</th>
<th>Criteria</th>
<th>Bias / Qualifier</th>
<th>Decision / rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1425103-03</td>
<td>NA</td>
<td>1,000</td>
<td>R</td>
<td>Ignore result</td>
</tr>
<tr>
<td>L1425103-04</td>
<td>740</td>
<td>1,000</td>
<td>indeterminate</td>
<td>FD-RPD</td>
</tr>
<tr>
<td>L1425103-05 FD</td>
<td>1230</td>
<td>1,000</td>
<td>indeterminate</td>
<td>FD – RPD</td>
</tr>
</tbody>
</table>

Field duplicate discussion

**Connecticut Department of Energy and Environmental Protection**
Lunch
45 Minutes

Laboratory Case Narratives

Michael Ainsworth
HRP Associates, Inc.
mike.ainsworth@hrpassociates.com
Laboratory Case Narratives

• States whether data meets RCP standards.

• Lists non-conformances and issues related to matrix interferences, sampling, lab analyses, quality control, etc.

• Provides additional information regarding the samples and analytical results.
Case Narrative Examples

General topics/categories:

- Matrix Interferences
- Reporting Limits
- Analyte Issues
- Physical Characteristics of Sample
- Sampling Procedures
- Lab Method Issues
- Lab Quality Control/Acceptance Criteria/Surrogates
- Lack of RCP Criteria

“There were no anomalies associated with the reported data.”
Case Narrative Examples

Physical Characteristics

“The VOA vials preserved with deionized water were received frozen upon custody transfer to laboratory representative.”

• Sample is valid as long as:
  ➢ Seal is not broken
  ➢ Vial is not cracked
  ➢ Vial was frozen by the client or lab within 48 hrs
  ➢ Holding times have not been exceeded

• Review the COC for time of collection and freezing

Case Narrative Examples

Sampling Issues

“The methanol VOA vial was cracked. We have extracted in house.”

• RCPs were not met.

• Is the data usable?
  ➢ Depends on stage of investigation
  ➢ High results may be usable for screening
  ➢ Use with multiple lines of evidence
  ➢ Resample if more accurate results are required
Case Narrative Examples

Sampling Issues

“The MeOH vial contained a large amount of soil as compared to the extractant (greater than the 1:1 ratio referenced in EPA Method 5035). The results reported from the diluted aliquot are therefore based on the sample as received.”

• Result: data did not meet RCP criteria
• Low bias
• Is the data usable?
  ➢ Stage of investigation
  ➢ Levels detected
  ➢ CSM

Case Narrative Examples

Matrix Interferences

“Due to matrix interferences, selected samples were analyzed for certain analyses on a diluted basis. In such cases, the reporting levels have been raised accordingly.”

• Are contaminants of concern involved?

• Are samples being used to meet RSR criteria?

• Can the lab clean up and re-run the sample within holding time?
Case Narrative Examples

Sample Dilution

“Sample dilution was required for high concentrations of target analytes to be within the instrument calibration range.”

• Sample dilution is often required
• Are raised Reporting Levels over RSR criteria?
• Review diluted and undiluted results – may help

Case Narrative Examples

Estimated Values

“The result reported for TCE is an estimated value (“E”) because it was greater than the highest calibration standard analyzed.”

• Results meet RCPs
• Can data be used for quantitative purposes?
• Results are only accurate within the calibration range and limitations of the equipment and method.
• If there are two sets of data due to dilution, are both out of calibration range?
Case Narrative Examples

**QA/QC Blanks**

“Analyte is found in the associated blank as well as in the sample.”

Significance depends on:

- Which blank was it found in (lab, trip, or field blank)?
- What substance and concentration? 10 X rule.
- Contaminant of concern?
- Certain compounds are common laboratory contaminants:
  - Methylene chloride
  - Acetone
  - MEK

Case Narrative Examples

**Potentially Difficult Compounds**

“According to CTDEEP RCP Quality Assurance and Quality Control Requirements for VOCs by Method 8260, Table 1A, recovery for some VOC analytes has been deemed potentially difficult.”

- RCPs list any compounds that are potentially difficult to quantify.
- Methods 8260 and 8270
## Case Narrative Examples

### Potentially Difficult Compounds

**EPA Method 8260**

- Acetone
- Bromomethane
- Chloroethane
- Dichlorodifluoromethane
- Dibromochloromethane
- Hexachlorobutadiene
- 2-butanone (MEK)
- Trichlorofluoromethane
- 4-methyl-2-pentanone

### Potentially Difficult Compounds

**EPA Method 8270**

- Dimethyl phthalate
- 4-nitrophenol
- Phenol
- 4- methylphenol
- 2-methylphenol
- 2,4-dinitrophenol
- Pentachlorophenol
- 4-chloroaniline
Case Narrative Examples

Analytical Method Issues

“This sample was analyzed for VOCs outside the EPA recommended holding time of 14 days per client request.”

- How long after? 1 day? 10 days?
- Data could possibly be used for screening or with multiple lines of evidence.
- Not usable for RSR compliance
- PCBs less prone to degradation after 14 days

Case Narrative Examples

Laboratory Calibration Issues

“The following analytes do not meet RCP criteria in the SVOC initial calibration (ICAL) with Response Factors of <0.05: 2,4-Dinitrophenol, 4,6-Dinitro-2-methylphenol, Hexachlorocyclopentadiene and Pentachlorophenol.”

- Results based on low response factors (RF) for initial calibration (ICAL) are estimated values.
- Impact depends on:
  - Compounds contaminants of concern?
  - Use of data
  - RLs over RSR criteria?
Case Narrative Examples

Lab Method Issues

“For Method 6010, only RCRA 8 metals were requested and reported.”

• Similar for PAHs (part of Method 8270) or any other methods.

Case Narrative Examples

Method Acceptance Criteria

“Benzidine percent recovery (30%) is outside individual acceptance criteria (40-140%), but within overall method allowances. Results of the following samples are considered to have a potentially low bias.”

“Chloroethane percent recovery (138%) is outside individual acceptance criteria (70-130%), but within overall method allowances. Results are considered to have a potentially high bias.”
Case Narrative Examples

Method Acceptance Criteria

• 20% of total number of compounds can be outside of acceptance criteria for method compliance
• Contaminants of concern?
• Use of results?
• RSR criteria?

Surrogates - SVOCs

“Acid surrogate recovery outside of control limits. The data was accepted based on valid recovery of remaining two acid surrogates.”

Surrogate recovery for SVOC analysis

<table>
<thead>
<tr>
<th>Surrogate</th>
<th>% Recovery</th>
<th>Within Limits?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 4, 6 - Tribromophenol</td>
<td>11%</td>
<td>✗</td>
</tr>
<tr>
<td>Terphenyl-d14</td>
<td>86%</td>
<td>✓</td>
</tr>
<tr>
<td>Phenol-D5</td>
<td>78%</td>
<td>✓</td>
</tr>
</tbody>
</table>

Acceptable Limits are **30% - 130%**
### Case Narrative Examples

**Surrogates - VOCs**

“Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogates with three required by program methods.”

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Surrogate Recovery</th>
<th>Within Limits?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dibromofluoromethane</td>
<td>62%</td>
<td>✗</td>
</tr>
<tr>
<td>1, 2 - Dichloroethane - d4</td>
<td>112%</td>
<td>✔</td>
</tr>
<tr>
<td>Toluene - d8</td>
<td>106%</td>
<td>✔</td>
</tr>
<tr>
<td>4 - Bromofluorobenzene</td>
<td>101%</td>
<td>✔</td>
</tr>
</tbody>
</table>

Acceptable Limits are **70% - 130%**

---

**Acceptance Limits for Duplicates**

**RPD**

“The Relative Percent Difference (RPD) of the sample duplicate exceeded the QC control limit of 20%; however precision is demonstrated with acceptable RPD values for MS/MSD.”

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Duplicate</th>
<th>MS/MSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>21</td>
<td>✔</td>
</tr>
<tr>
<td>Lead</td>
<td>57</td>
<td>✔</td>
</tr>
</tbody>
</table>

Connecticut Department of Energy and Environmental Protection
Case Narrative Examples

No RCP Criteria

“There are currently no RCP criteria for one or more analytes or methods requested, however QC data has been reported and meets the requirements of each non-RCP method.”

- Information statement
- Some metals, waste characterization tests, etc.
- Understand your project’s objectives and laboratory SOPs
- If any listed analytes are important to the Site:
  - Request additional QA/QC information is necessary
  - Document that equivalent QA/QC was performed

Case Narrative Examples

“This compound was over the instrument calibration range and was not re-analyzed from the Methanol vial because a minimum 50x dilution factor is required. The dilution factor combined with reporting limit would mean the final concentration would be BRL.”

If a comment is unclear,

Contact the lab!
Case Study #1 Objectives

Provide an opportunity to go through the DQA/DUE process for a specific site. The focus on this case study is the DQA.

- The DQA will be guided
- The DUE will be presented
Case Study #1 Scenario

- Release from an in-ground wastewater treatment sump.
- Release investigated and remediated.
- Evaluate groundwater data to determine if remediation was successful.
- For purposes of this exercise, the analytical results will be compared to the GWPC.

DQA/DUE Process

**DQA**
- Identify nonconformances and summarize.

**DUE**
- Evaluate the effects of nonconformances on usability of sample data in relation to the intended purpose or alternative decision-making purposes.
Step 1: Perform the DQA

• Reminder: Appendix C of the DQA/DUE Guidance lists the information to be reviewed during a DQA.
• Summarize nonconformances on a DQA Worksheet.

Guided DQA

• Review laboratory report
  – Is the report complete? (The report for this case study is complete)
    • Laboratory Analysis RCP QA/QC Certification Form.
    • Chain of Custody Form.
    • Case Narrative Report.
    • Analytical Results.
    • QC Results.
  – Cross-reference batch numbers with sample numbers.
• Complete a DQA Worksheet
  – Note nonconformances only.
About DQA Worksheets

• Example worksheets may be modified.
• The example worksheets provided include RSR criteria, results, and preliminary DUE findings; -- this may work for smaller projects, but could be too cumbersome for large projects.
• Complete as you go through case narrative, lab QC information, other DQA tasks

Example DQA Worksheet

• Electronic versions, databases, or spreadsheets may be used.

• Contact your lab to see if they can provide a DQA or if they have a portal that allows you to pull and compile the data along with the respective QC samples.
Example DQA Worksheet

• For the purpose of this training, we will go through the DQA process MANUALLY

CASE STUDY 1
RCP DQA

Laboratory: JGBT
SDG: 08R-2469.0
Date Samples Collected: 4/17/2008
RCP Certification Form Included: Yes
Laboratory Case Narrative Included: Yes

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Lab #</th>
<th>Location #</th>
<th>Compound</th>
<th>QC Outlier</th>
<th>% Rec.</th>
<th>Rel. % Diff.</th>
<th>Results (ug/L)</th>
<th>GWPC</th>
<th>Comments</th>
</tr>
</thead>
</table>

This part can be entered in advance
This part is entered as you find issues
Data Package Review

Become Familiar with your Data Package

CASE STUDY 1 – DATA DELIVERABLES

RCP Certification Form – page 1 of 54
Case Narrative – page 2 and 3 of 54
Sample Summary – page 4 of 54
Lab Reports – page 5 through 33 of 54
QC Report – page 34 through 50 of 54
Batch Association – page 51 and 52 of 54
Method Summary – page 53 and 54 of 54

Chain of Custody Form – Last page of data package

Review of Laboratory Report Package

Review Laboratory Analysis RCP Certification Form (LCF):

– Are all the questions in the LCF answered?
– Note which questions are answered “NO.”

Are these “NO” responses fully explained in the Case Narrative Report?

– Laboratory should not have made any changes to Form
RCP Certification Form

Reasonable Confidence Protocol

Laboratory Analysis QAQC Certification Form

Laboratory Name:

Project Location:

Laboratory Sample (Drugi):

Sampling Date:

List RCP Methods Used (e.g., R208, R279, others):

1. For each analytical method/protocol in this laboratory report package, were all required QAQC performance criteria followed, including the requirement to comply with all clinically
   testing, quality assurance guidelines, as specified in the CTCPR method-specific
   reasonable confidence protocol documents?

   Yes
   No

2. Were all samples received by the laboratory in a condition consistent with the description
   in the associated chain-of-custody documents?

   Yes
   No

3. Were samples handled at an appropriate temperature (-4°C)?

   Yes
   No

4. Were all QAQC performance criteria specified in the CTCPR reasonable confidence
   protocol documents addressed?

   Yes
   No

5. Were reporting limits specified or referenced on the chain-of-custody?

   Yes
   No

6. Were these reporting limits used?

   Yes
   No

7. For each analytical method/protocol in this laboratory report package, were results
   reported for all constituents identified in the method-specific analysis plan presented in
   the reasonable confidence protocol documents?

   Yes
   No

8. Are project-specific quality control and laboratory standards included in this document?

   Yes
   No

Case Study 1 – Data Package
Page 1 of 54

RCP Certification Form

Is the LCF signed?

Bottom Section of 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 question #18 is "No", the data package does not meet the requirements
for "Reasonable Confidence".

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

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

Authorized Signature: Glen Williams

Position: Laboratory Director

Date: 5/5/2008

Printed Name: Glen Williams

100 Pelroy Drive, Anytown, CT 06080
Phone: (800) 869-0000

This report shall not be reproduced except in its entirety.

Case Study 1 – Data Package
Page 1 of 54
Chain of Custody

• Review Chain of Custody to ensure form is complete and correct.
• Correct any errors with a single line, initial, and note reason for correction.
  • Were samples appropriately preserved/refrigerated/iced?
  • Contact the laboratory for help or clarification if needed.
  • Were all analyses performed?

Note: the Chain of Custody should be also reviewed at the time of sampling too.

Chain of Custody Evaluation

• RSR criteria were not noted on Chain of Custody.
  – In this case, GWPC.

• A review of the analytical results will show that two samples were not analyzed for ETPH as requested on the Chain of Custody.
REPORT ON LABORATORY EXAMINATIONS

Laboratory No.: LS08003507
Client Sample ID: MW-4
Sample Matrix: Groundwater
Received Date: Thursday, April 17, 2008
Collected By: ENVIROBIZ, INC.
Collect Date: Thursday, April 17, 2008
Source: KRRG Plating, Big City, CT
Sample ID: Monitoring Well Sample

Analysis Method: SW-846 8260B

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Units:</th>
<th>Reporting Limit</th>
<th>Analyst Date</th>
<th>Batch#</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003507 Acetone</td>
<td>ND</td>
<td>ug/L</td>
<td>1 10.0</td>
<td>MS</td>
<td>4/30/2016 45165</td>
</tr>
<tr>
<td>LS08003507 Acrylonitrile</td>
<td>ND</td>
<td>ug/L</td>
<td>1 0.5</td>
<td>MS</td>
<td>4/30/2008 45165</td>
</tr>
<tr>
<td>LS08003507 Benzene</td>
<td>ND</td>
<td>ug/L</td>
<td>1 0.5</td>
<td>MS</td>
<td>4/30/2008 45165</td>
</tr>
<tr>
<td>LS08003507 Bromobenzene</td>
<td>ND</td>
<td>ug/L</td>
<td>1 0.5</td>
<td>MS</td>
<td>4/30/2008 45165</td>
</tr>
<tr>
<td>LS08003507 n-Butylbenzene</td>
<td>ND</td>
<td>ug/L</td>
<td>1 0.5</td>
<td>MS</td>
<td>4/30/2008 45165</td>
</tr>
<tr>
<td>LS08003507 sec-Butylbenzene</td>
<td>ND</td>
<td>ug/L</td>
<td>1 0.5</td>
<td>MS</td>
<td>4/30/2008 45165</td>
</tr>
<tr>
<td>LS08003507 tert-Butylbenzene</td>
<td>ND</td>
<td>ug/L</td>
<td>1 0.5</td>
<td>MS</td>
<td>4/30/2008 45165</td>
</tr>
<tr>
<td>LS08003507 Bromochloromethane</td>
<td>ND</td>
<td>ug/L</td>
<td>1 0.5</td>
<td>MS</td>
<td>4/30/2008 45165</td>
</tr>
</tbody>
</table>

Note: the sample from MW-7 is also missing the ETPH analytical results.
### DQA Worksheet

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>LAB #</th>
<th>LOCATION ID #</th>
<th>COMPOUND</th>
<th>QC OUTLIER</th>
<th>%R</th>
<th>RPD</th>
<th>BIAS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003507</td>
<td>LS08003507</td>
<td>MW-4</td>
<td>ETPH</td>
<td>No result reported</td>
<td></td>
<td></td>
<td></td>
<td>ETPH analysis not performed</td>
</tr>
<tr>
<td>LS08003510</td>
<td>LS08003510</td>
<td>MW-7</td>
<td>ETPH</td>
<td>No result reported</td>
<td></td>
<td></td>
<td></td>
<td>ETPH analysis not performed</td>
</tr>
</tbody>
</table>

Initial information in these columns was already entered in advance to speed up process during the DQA.

Information in these columns is entered as issues are identified.

### Laboratory Narrative

- Review the narrative for findings (i.e., QC nonconformances) and request additional information from the laboratory, if applicable.
- Check that holding times and preservation requirements have been met.
- Note nonconformances on DQA worksheet.
### DQA Worksheet

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>LAB #</th>
<th>LOCATION ID #</th>
<th>COMPOUND</th>
<th>QC</th>
<th>OUTLIER</th>
<th>REL. % DIFF.</th>
<th>BIAS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003513</td>
<td>LS08003513</td>
<td>MW-2m</td>
<td>Cadmium</td>
<td>MS</td>
<td>MSD</td>
<td>50.91</td>
<td>Low</td>
<td>Low Recovery</td>
</tr>
</tbody>
</table>

Note: MS/MSD RCP Limits for Metals
%R: 75-125%

Since the Sample # and Lab # are the same in this deliverable example, the Laboratory # has been dropped on the presentation slides to save space.

### Case Narrative

**Metals**

**Batch 45066**

Zinc was detected in the method blank at 0.01 mg/L.

Batch applies to samples MW-1m through MW-6m, but not MW-7m.
**Batch Association**

**Analysis Method:** CT ETPH

<table>
<thead>
<tr>
<th>Lab #</th>
<th>Client ID#</th>
<th>Analysis Batch #</th>
<th>Prep Batch #</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003504</td>
<td>MW-1</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003505</td>
<td>MW-2</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003506</td>
<td>MW-3</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003508</td>
<td>MW-5</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003509</td>
<td>MW-6</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003511</td>
<td>MW-8</td>
<td>45137</td>
<td>5801</td>
</tr>
</tbody>
</table>

**Analysis Method:** SW-846 6010B

<table>
<thead>
<tr>
<th>Lab #</th>
<th>Client ID#</th>
<th>Analysis Batch #</th>
<th>Prep Batch #</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003512</td>
<td>MW-1m</td>
<td>45066</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003513</td>
<td>MW-2m</td>
<td>45066</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003514</td>
<td>MW-3m</td>
<td>45066</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003515</td>
<td>MW-4m</td>
<td>45066</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003516</td>
<td>MW-5m</td>
<td>45066</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003517</td>
<td>MW-6m</td>
<td>45085</td>
<td>5797</td>
</tr>
<tr>
<td>LS08003518</td>
<td>MW-7m</td>
<td>45085</td>
<td>5797</td>
</tr>
</tbody>
</table>

**Analysis Method:** SW-846 7010

<table>
<thead>
<tr>
<th>Lab #</th>
<th>Client ID#</th>
<th>Analysis Batch #</th>
<th>Prep Batch #</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003512</td>
<td>MW-1m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003513</td>
<td>MW-2m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003514</td>
<td>MW-3m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003515</td>
<td>MW-4m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003516</td>
<td>MW-5m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003517</td>
<td>MW-6m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003518</td>
<td>MW-7m</td>
<td>45131</td>
<td>5797</td>
</tr>
</tbody>
</table>

**QC Report**

**QC REPORT**

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Analyte</th>
<th>Blank Result</th>
<th>% RSD</th>
<th>LLOQ</th>
<th>HLOQ</th>
<th>Analyte Date</th>
<th>Prep Batch #</th>
<th>Analysis Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blanks</td>
<td>Mercury</td>
<td>4564</td>
<td>ND</td>
<td>0.0002 mg/l</td>
<td>4.22.2008</td>
<td>5794</td>
<td>SW-846 1430A</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Arsenic</td>
<td>4548</td>
<td>ND</td>
<td>0.0004 mg/l</td>
<td>4.22.2008</td>
<td>5785</td>
<td>SW-846 7011</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Lead, SPFP</td>
<td>4540</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.23.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Cadmium</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.23.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Chromium</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.23.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Copper</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.23.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Nickel</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.23.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Silver</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.23.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Cadmium</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.24.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Chromium</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.24.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Copper</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.24.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Nickel</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.24.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
<tr>
<td>Blanks</td>
<td>Silver</td>
<td>4548</td>
<td>ND</td>
<td>0.01 mg/l</td>
<td>4.24.2008</td>
<td>5795</td>
<td>SW-846 4010B</td>
<td></td>
</tr>
</tbody>
</table>

**Case Study 1 – Data Package**

Page QC 51 of 54
Sample | Location ID | Compound | QC | % Rec. or Blank Contamination | Result | Comments
---|---|---|---|---|---|---
LS08003512 | MW-1m | Zinc | Method Blank | 0.01 mg/l detected in blank | ND<0.01 | 
LS08003513 | MW-2m | Zinc | Method Blank | 0.01 mg/l detected in blank | ND<0.01 | 
LS08003514 | MW-3m | Zinc | Method Blank | 0.01 mg/l detected in blank | ND<0.01 | 
LS08003515 | MW-4m | Zinc | Method Blank | 0.01 mg/l detected in blank | 0.029 | Action Level = 0.05 mg/L. Result < 5X Action Level 
LS08003516 | MW-5m | Zinc | Method Blank | 0.01 mg/l detected in blank | ND<0.01 | 
LS08003517 | MW-6m | Zinc | Method Blank | 0.01 mg/l detected in blank | 0.018 | Action Level = 0.05 mg/L. Result < 5X Action Level 

Zinc is a common laboratory contaminant – use 5X Rule. Make sure blank and sample units are the same when applying 5X and 10X Rules (i.e., trip blank with trip). See Sec. 4.2.3 of guidance.

Case Narrative

Metals
Batch 45085

The laboratory control sample for prep batch 5795 was outside RCP acceptance criteria for cadmium (57.47%) and copper (60.93%).
### Batch Association

**Analysis Method:** CT ETPH

<table>
<thead>
<tr>
<th>Lab #</th>
<th>Client ID#</th>
<th>Analysis Batch #</th>
<th>Prep Batch #</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003504</td>
<td>MW-1</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003505</td>
<td>MW-2</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003506</td>
<td>MW-3</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003508</td>
<td>MW-5</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003509</td>
<td>MW-6</td>
<td>45137</td>
<td>5801</td>
</tr>
<tr>
<td>LS08003511</td>
<td>MW-8</td>
<td>45137</td>
<td>5801</td>
</tr>
</tbody>
</table>

**Analysis Method:** SW-846 6010B

<table>
<thead>
<tr>
<th>Lab #</th>
<th>Client ID#</th>
<th>Analysis Batch #</th>
<th>Prep Batch #</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003512</td>
<td>MW-1m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003513</td>
<td>MW-2m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003514</td>
<td>MW-3m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003515</td>
<td>MW-4m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003516</td>
<td>MW-5m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003517</td>
<td>MW-6m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003518</td>
<td>MW-7m</td>
<td>45137</td>
<td>5797</td>
</tr>
</tbody>
</table>

**Analysis Method:** SW-846 7010

<table>
<thead>
<tr>
<th>Lab #</th>
<th>Client ID#</th>
<th>Analysis Batch #</th>
<th>Prep Batch #</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003512</td>
<td>MW-1m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003513</td>
<td>MW-2m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003514</td>
<td>MW-3m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003515</td>
<td>MW-4m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003516</td>
<td>MW-5m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003517</td>
<td>MW-6m</td>
<td>45051</td>
<td>5795</td>
</tr>
<tr>
<td>LS08003518</td>
<td>MW-7m</td>
<td>45137</td>
<td>5797</td>
</tr>
</tbody>
</table>

### QC Report

**JGBT Environmental, Inc.**

**QC Number**

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Analyte Batch #</th>
<th>Blank Result</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>Analysis Date</th>
<th>Prep Batch #</th>
<th>Analysis Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>45000</td>
<td>99.9</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>45000</td>
<td>106.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>45000</td>
<td>97.1</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>45000</td>
<td>97.5</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Bromide</td>
<td>45000</td>
<td>85.4</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Phosphate</td>
<td>45000</td>
<td>97.1</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Sulfate</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Fluoride</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Oxalate</td>
<td>45000</td>
<td>97.5</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Ascorbic Acid</td>
<td>45000</td>
<td>97.5</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>45000</td>
<td>97.5</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Nitrate</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Nitrite</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Phosphoric Acid</td>
<td>45000</td>
<td>97.5</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Sulfamic Acid</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Soluble Solids</td>
<td>45000</td>
<td>97.5</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Ethyl Alcohol</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Ethyl Acetate</td>
<td>45000</td>
<td>97.5</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
<tr>
<td>Total Solids</td>
<td>45000</td>
<td>93.3</td>
<td>85 - 115 %</td>
<td>4/12/2000</td>
<td>5785</td>
<td>SW-846 6010B</td>
<td></td>
</tr>
</tbody>
</table>

- Laboratory Control Samples

**Source:**  
**Date:** 05/29/2017  
**Page:** QC 38 of 54
# DQA Worksheet

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>LOCATION ID</th>
<th>COMPOUND</th>
<th>QC OUTLIER</th>
<th>%R</th>
<th>RPD</th>
<th>BIAS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003518</td>
<td>MW-7m</td>
<td>Cadmium</td>
<td>Lab. Control Sample</td>
<td>57.47</td>
<td></td>
<td>low</td>
<td>LCS not reanalyzed by laboratory</td>
</tr>
<tr>
<td>LS08003518</td>
<td>MW-7m</td>
<td>Copper</td>
<td>Lab. Control Sample</td>
<td>60.93</td>
<td></td>
<td>low</td>
<td>LCS not reanalyzed by laboratory</td>
</tr>
</tbody>
</table>

**Note:** Laboratory Control Sample RCP Limits for Metals
%Recovery: 85-115%

There is only one sample in Prep Batch 5797.

---

# DQA Worksheet

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>LOCATION ID</th>
<th>COMPOUND</th>
<th>QC OUTLIER</th>
<th>%Rec.</th>
<th>Rel. % Diff.</th>
<th>BIAS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003504</td>
<td>MW-1</td>
<td>ETPH</td>
<td>Surrogate: n-Pentacosane</td>
<td>153</td>
<td></td>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Laboratory Control Sample RCP Surrogate Limits for CT ETPH
%R: 50-150%

Only one sample is affected.
Case Narrative

CT ETPH
Batch 45137

A high percent recovery (153%) for surrogate n-pentacosane was reported for Sample LS08003504.

Case Study 1 – Data Package
Page 3 of 54
Laboratory Analytical Data Review

- Are the reporting limits listed and are they less than regulatory criteria requested on the Chain of Custody?
- Was anything reported above laboratory Reporting Limits?
- Check dilution factor to see if a dilution was performed. Dilution factors result in elevated Reporting Limits (RLs).
Laboratory Report Data Review

Analytical Results:
- Only concentrations greater than Reporting Limits should be reported, no “J” flags.
- “B” flags to be used for results with contamination in a blank.
- Soil and sediments results reported on a dry weight basis.

Evaluation of Sample Results

- Partial list of RCP Method metals analyzed, as requested in the Chain of Custody.
- Requested list covers constituents of concern.
- Reporting Limits achieved are less than or equal to the GWPC.
Laboratory QC Report

• Review QC results to become familiar with the data. These results include: method blanks, field blanks, Laboratory Control Samples, surrogates, etc.

• Matrix Spike/Matrix Spike Duplicate (MS/MSD) was requested for this case study.

Final DQA Worksheet

• Relates all QC nonconformances to samples and sample locations.

• DQA worksheets (spreadsheets) can be sorted by:
  • Sample
  • Sample location
  • Constituent of concern
  • QC Outlier

• DQA spreadsheets for individual Sample Delivery Groups (SDGs) can be combined to assess overall evaluation of data and trends.

• Forms the basis of the Data Usability Evaluation.
**Final DQA Worksheet**

**Groundwater Monitoring – Round 1**

**RCP DQA Worksheet**

**Laboratory:** JGBT

**SDG:** 680-0444-0

**Date Samples Collected:** 4/17/2008

**RCP Certification Form Included:** Yes

**Laboratory Case Narrative Included:** Yes

**CASE STUDY #1**

**Laboratory Case Narrative Included:** Yes

**Note 1:** Bias High: reported result may be lower than reported, RLs are accepted as reported.

**Note 2:** Bias Low: reported result may be higher than reported, RLs may be higher.

**RCP VOC list analyzed for total xylenes, not isomers**

**RCP Metal list did not analyze full RCP metal list**

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>LAB #</th>
<th>LOCATION ID#</th>
<th>COMPOUND</th>
<th>QC OUTLIER</th>
<th>Method Blank Contamination</th>
<th>RPD</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003504</td>
<td>LS08002004</td>
<td>MW-1 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>LCS</td>
<td>60</td>
<td>low</td>
<td>RCP poorly performing compound</td>
</tr>
<tr>
<td>LS08003505</td>
<td>LS08003505</td>
<td>MW-2 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>LCS</td>
<td>60</td>
<td>low</td>
<td>RCP poorly performing compound</td>
</tr>
<tr>
<td>LS08003506</td>
<td>LS08003506</td>
<td>MW-3 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>LCS</td>
<td>60</td>
<td>low</td>
<td>RCP poorly performing compound</td>
</tr>
<tr>
<td>LS08003507</td>
<td>LS08003507</td>
<td>MW-4 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>No result reported</td>
<td>ETPH analysis not performed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS08003508</td>
<td>LS08003508</td>
<td>MW-5 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>LCS</td>
<td>60</td>
<td>low</td>
<td>RCP poorly performing compound</td>
</tr>
<tr>
<td>LS08003509</td>
<td>LS08003509</td>
<td>MW-6 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>LCS</td>
<td>60</td>
<td>low</td>
<td>RCP poorly performing compound</td>
</tr>
<tr>
<td>LS08003510</td>
<td>LS08003510</td>
<td>MW-7 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>No result reported</td>
<td>ETPH analysis not performed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>LAB #</th>
<th>LOCATION ID#</th>
<th>COMPOUND</th>
<th>QC OUTLIER</th>
<th>Method Blank Contamination</th>
<th>RPD</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003511</td>
<td>LS08003511</td>
<td>MW-8 ETPH</td>
<td>1,1,2,2-tetrachloroethane</td>
<td>LCS</td>
<td>60</td>
<td>low</td>
<td>RCP poorly performing compound</td>
</tr>
<tr>
<td>LS08003512</td>
<td>LS08003512</td>
<td>MW-9n Zinc</td>
<td>Method Blank Contamination</td>
<td>0.01 mg/L detected in blank</td>
<td>Common laboratory contaminant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS08003513</td>
<td>LS08003513</td>
<td>MW-9n Zinc</td>
<td>Method Blank Contamination</td>
<td>0.01 mg/L detected in blank</td>
<td>Common laboratory contaminant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS08003514</td>
<td>LS08003514</td>
<td>MW-9n Zinc</td>
<td>Method Blank Contamination</td>
<td>0.01 mg/L detected in blank</td>
<td>Common laboratory contaminant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS08003515</td>
<td>LS08003515</td>
<td>MW-9n Zinc</td>
<td>Method Blank Contamination</td>
<td>0.01 mg/L detected in blank</td>
<td>Common laboratory contaminant SK Action Level (AL) &gt; 0.05 mg/L. Result is less than 10X AL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS08003516</td>
<td>LS08003516</td>
<td>MW-9n Zinc</td>
<td>Method Blank Contamination</td>
<td>0.01 mg/L detected in blank</td>
<td>Common laboratory contaminant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS08003517</td>
<td>LS08003517</td>
<td>MW-9n Zinc</td>
<td>Method Blank Contamination</td>
<td>0.01 mg/L detected in blank</td>
<td>Common laboratory contaminant SK Action Level (AL) &gt; 0.05 mg/L. Result is less than 10X AL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS08003518</td>
<td>LS08003518</td>
<td>MW-9n Zinc</td>
<td>Method Blank Contamination</td>
<td>0.01 mg/L detected in blank</td>
<td>Common laboratory contaminant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAMPLE #</th>
<th>LAB #</th>
<th>LOCATION ID#</th>
<th>COMPOUND</th>
<th>QC OUTLIER</th>
<th>Method Blank Contamination</th>
<th>RPD</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS08003519</td>
<td>LS08003519</td>
<td>MW-9n Zinc</td>
<td>Copper</td>
<td>LCS</td>
<td>57.47</td>
<td>low</td>
<td>LCS not reanalyzed by laboratory</td>
</tr>
</tbody>
</table>
Data Usability Evaluation

The DQA worksheet summarizes nonconformances that need to be evaluated during the DUE.

• On the DUE Worksheet provided, Page 1 should be filled in first
  – Critical reminder only the nonconformances need to be noted, but supplemental information can be added to help explain items for Page 2.

• How nonconformances affect usability on the specific project are then indicated on Page 2 of the DUE worksheet.

---

DUE Worksheet

This is intended to be a succinct summary of nonconformances to help start the DUE.
DUE Worksheet
Page 1

• Reasonable Confidence
  ▪ Question No. 1 on RCP Form -- “No”, because LCS for cadmium and copper not re-analyzed.

• Chain of Custody Evaluation
  ▪ No ETPH analysis run for MW-4 and MW-7.

• Sample Result Evaluation
  ▪ Partial list of metals analyzed, as requested on Chain of Custody.

DUE Worksheet
Page 1

• Blanks
  ▪ Zinc in method blank at a concentration of 0.01 mg/L or 10 µg/L. Zinc is a common laboratory contaminant. Apply EPA “10 times” rule.

• Laboratory Control Samples
  ▪ MW-7 -- copper and cadmium low bias
  ▪ For all samples -- 1,1,2,2-tetrachloroethane low bias

• Surrogates
  ▪ ETPH – N-Pentacosane high bias for MW-1 only
DUE Worksheet

Page 1

• Matrix Spike and Matrix Spike Duplicates

MS/MSD from MW-8
  ▪ PCE, TCE low bias applies to all GW samples
  ▪ Cis-1,2-DCE high bias applies to all GW samples
  ▪ High RPD for 1,1-DCE; 2-hexanone*; acetone*; acrylonitrile; dichlorodifluoromethane*; toluene; and trans-1,2-DCE

MS/MSD from MW-2
  ▪ low bias for cadmium

* = poorly performing compounds

---

Summary of Detected Results and QA/QC Deficiencies

Case Study #1 - Summary of Detected Results and QA/QC Deficiencies

<table>
<thead>
<tr>
<th>Constituent Detected</th>
<th>RSR GWPC</th>
<th>MW-1</th>
<th>MW-2</th>
<th>MW-3</th>
<th>MW-4</th>
<th>MW-5</th>
<th>MW-6</th>
<th>MW-7</th>
<th>MW-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETPH</td>
<td>250 µg/L</td>
<td>120 µg/L</td>
<td>No result</td>
<td>No result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cis,1,2-Dichloroethane</td>
<td>70 µg/L</td>
<td>88 µg/L</td>
<td>66 µg/L</td>
<td>76 µg/L</td>
<td>61 µg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichloroethene</td>
<td>5 µg/L</td>
<td>4.4 µg/L</td>
<td>2.5 µg/L</td>
<td>4.0 µg/L</td>
<td>2.6 µg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toluene</td>
<td>1,000 µg/L</td>
<td>0.6 µg/L</td>
<td>0.6 µg/L</td>
<td>0.6 µg/L</td>
<td>0.6 µg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barium</td>
<td>1 mg/L</td>
<td>0.011 mg/L</td>
<td>0.023 mg/L</td>
<td>0.017 mg/L</td>
<td>0.020 mg/L</td>
<td>0.011 mg/L</td>
<td>0.037 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.005 mg/L</td>
<td>0.004 mg/L</td>
<td>0.004 mg/L</td>
<td>0.004 mg/L</td>
<td>0.005 mg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>1 mg/L</td>
<td>0.037 mg/L</td>
<td>0.037 mg/L</td>
<td>0.037 mg/L</td>
<td>0.037 mg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>5 mg/L</td>
<td>0.025 mg/L</td>
<td>0.029 mg/L</td>
<td>0.018 mg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>1.1 mg/L</td>
<td>0.045 mg/L</td>
<td>0.047 mg/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

QAQC Deficiency:
- Low bias for MS/MSD
- Method Blank Contamination
- LCS low bias
- Surrogate high bias
- MS/MSD high bias

Note: QA/QC deficiency for 1,1,2,2-tetrachloroethane also (low bias due to LCS), but all results were “ND.”

Potential Usability issues highlighted in red.
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. These results will be used as the first quarter of four quarters of groundwater sampling to demonstrate compliance with the RSRs and evaluate effectiveness of remediation.

Reasonable Confidence not achieved. Question 1 answered "No" on RCP Certification Form – LCS lower than acceptance criteria for cadmium and copper, did not reanalyze, as required by RCPs. See MS/MSD’s summary below. No impact to usability from LCS.

RLs not noted on Chain of Custody, but RLs achieved are appropriate for a GA Area.

Partial list of RCP Method metals analyzed, as requested on the Chain of Custody form. Requested list covers constituents of concern. No impact to data usability.

ETPH analyses were not performed on samples from MW-4 and MW-7, since containers broken in transit to lab. Additional samples from MW-4 and MW-7 necessary. No data to evaluate for usability.

Zinc was found in the method blank at 10 μg/L. Zinc is a common laboratory contaminant. Application of the EPA “10 times” rule means that zinc would have to be reported at a concentration greater than 100 μg/L to be considered present in a sample collected during this sampling event. Based on this, the zinc detected in samples from MW-4 and MW-6 is likely to be present as a result of laboratory contamination. No impact to data usability.

The LCS for cadmium for MW-7 indicates low bias.

The MS/MSD for metals from sample MW-2 indicates low bias for cadmium, which applies to all samples. Cadmium was reported at a concentration close to the GWPC in samples from MW-2, MW-6, and MW-7. Data usability potentially impacted for these results.

The LCS for copper for MW-7 indicates low bias. However, there are no reported results close to the GWPC for copper. No impact to usability.

ETPH - The result for the surrogate N-pentacosane shows high bias for MW-2 only. ETPH result for this sample is less than GWPC. No impact to usability.

The LCS for 1,1,2,2-tetrachloroethane indicates low bias, which applies to all samples. Reported results for 1,1,2,2-tetrachloroethane were "ND" for all samples, and the reporting limit is at the GWPC. Therefore, actual concentrations could be above the criterion. Additional sampling will be used to further evaluate this issue.

The LCS for TCE indicates low bias. Matrix Spike and Matrix Spike Duplicate indicates low bias for TCE for samples MW-1, MW-3, and MW-6, for which TCE concentrations were detected close to the GWPC. Therefore, the reported concentrations for TCE could actually be greater than GWPC.

Matrix Spike and Matrix Spike Duplicate indicate low bias for cadmium. The reported analytical results for cadmium are close to GWPC for samples MW-2, MW-6, and MW-7. Therefore, the reported concentrations for cadmium may actually be greater than the GWPC.

Laboratory Control Sample for 1,1,2,2-tetrachloroethane indicates low bias, which applies to all samples. Reported results for 1,1,2,2-tetrachloroethane were "NO" for all samples, and the reporting limit is at the GWPC. Therefore, actual concentrations may be greater than the GWPC.

In this case, additional sampling will be conducted during compliance monitoring to further evaluate these issues.

Results of DUE

• With the exception of the analytical data for 1,1,2,2-tetrachloroethane, TCE, and cadmium, the analytical data are of adequate quality and sufficient accuracy, precision, and sensitivity for the intended purpose.

  – Matrix Spike and Matrix Spike Duplicate indicates low bias for TCE for samples MW-1, MW-3, and MW-6, for which TCE concentrations were detected close to the GWPC. Therefore, the reported concentrations for TCE could actually be greater than GWPC.

  – Matrix Spike and Matrix Spike Duplicate indicate low bias for cadmium. The reported analytical results for cadmium are close to GWPC for samples MW-2, MW-6, and MW-7. Therefore, the reported concentrations for cadmium may actually be greater than the GWPC.

  – Laboratory Control Sample for 1,1,2,2-tetrachloroethane indicates low bias, which applies to all samples. Reported results for 1,1,2,2-tetrachloroethane were “NO” for all samples, and the reporting limit is at the GWPC. Therefore, actual concentrations may be greater than the GWPC.

  – In this case, additional sampling will be conducted during compliance monitoring to further evaluate these issues.
Results of DUE

• Nonconformances indicating low bias were noted for other constituents for which reported concentrations were well below the GWPC. No affect on usability.

• An ETPH surrogate indicated high bias, however since the reported concentration of ETPH is below the GWPC criteria, this bias has no affect on usability.

• There were no ETPH results for MW-4 and MW-7 because samples were broken during transit. Further sampling from these wells will be necessary to begin compliance monitoring.

Results of DUE

• Zinc was found in the laboratory blank. Zinc was either “ND” or found at concentrations much less than the GWPC in groundwater samples. Based on the application of the EPA “10 times” rule, the zinc detected can reasonable be attributed to laboratory contamination, and the reported results are well below GWPC. Usability is not affected.

• The laboratory will be contacted prior to the next sampling round to attempt to resolve issues QA/QC issues identified during this sampling event.
Groundwater samples collected from 7 wells at ERAG Plating were submitted to a state-certified analytical laboratory for analysis using the Reasonable Confidence Protocol (RCP) Methodology to evaluate whether remediation of a release of process waste from an in-ground wastewater treatment system was effective and whether compliance with the Ground Water Protection Criteria (GWPC) could be demonstrated. Four quarterly results of groundwater samples had been collected. This sampling event represented the first round of groundwater monitoring. A data quality assessment (DQA) and data uncertainty evaluation (DUE) were performed in accordance with CTDEP guidance.

Results of the DQA indicated that, in general, the analytical data are of adequate quality for the intended purpose. However, ETTH samples from wells MW-6 and MW-7 were not analyzed, as the containers were broken in transit to the laboratory; subsequent sampling is necessary, and these wells would not be monitored for ETTH. 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.

Zinc was detected in the laboratory blank and was either not detected for groundwater samples or was detected at concentrations less than 30 times the concentration reported for the laboratory blank. Using the EPA's 10 times rule to evaluate results, zinc detected in samples is likely a result of laboratory contamination.

Analytical results for Matrix blanks and Matrix Spike Standards (MSSs) indicate 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-4, and MW-7. Therefore, the reported concentrations for cadmium may actually be greater than the GWPC.

The result for the surrogate compound for ETTH indicates a potential high bias for sample MW-1. Reported concentrations for ETTH are above the GWPC for that sample. The LLS for 1,1,2,2-tetrachloroethane indicates no 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 MSSs indicate a potential low bias for TCE, which affects all samples. At locations MW-1, MW-3, and MW-4, TCE was detected at concentrations close to the GWPC. Therefore, the reported concentrations for TCE may actually be greater than the GWPC at these locations.

Additional QA/QC-conformance issues indicating potential low bias were noted for constituents that were reported at concentrations below the GWPC. 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 conversion of these 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-tetrachloroethane 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. Beliefs of the results for these three constituents for determining compliance with the GWPC 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 in 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.

Questions and Answers
Case Study #2

This case study uses the approach, and builds on concepts, presented in Case Study #1.

In this case study ...

- focus is on the DUE
- DQA will be presented
- Attendees will develop the DUE
- DUE will be discussed in an interactive format
Scenario – Case Study #2

• Former agricultural land

• Proposed mixed residential, commercial, and recreational development

• 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 the concentrations of pesticides greater than RDEC?  
    (For purposes of this case study, analytical results will be compared to RDEC only.)

Scenario – Case Study #2

• Ten shallow soil samples were collected.

• All samples were the same type of soil.

• Soil samples were analyzed by RCP Method 8081 for pesticides.

• Samples were collected and delivered to the laboratory on the same day on ice.
Case Study #2

Data Quality Assessment:
Summarized any data quality issues (nonconformances)

Reminders:
• Narratives are critical sources of information → identify nonconformances, particularly for QC elements not required to be included in the QC data portion of the laboratory analytical report

• Surrogates, Spikes, Blanks → Accuracy
• Duplicates → Precision
• Reporting Limits → Sensitivity
Rush Project - Laboratory Problems!

• The laboratory called the project manager to let them know that the Endrin/DDT standard indicated significant breakdown at the injection port (a significant RCP nonconformance).

• Because the client needed results right away, the project manager instructed the laboratory to report the results as is, with the Endrin/DDT standard breakdown nonconformances.

Review of DQA Information
Laboratory Certification Form

1. For each analytical method referenced in this laboratory report package, were all specified QAQC performance criteria followed (including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEP method-specific Reasonable Confidence Protocol document)?

2. Were the method specified preservation and holding time requirements met?

3. Were all samples received by the laboratory in a condition consistent with that described on the associated chain of custody document(s)?

4. Were all QAQC performance criteria specified in the CT DEP Reasonable Confidence Protocol document met?

5a. Were reporting limits specified or referenced on the chain of custody?

5b. Were those reporting limits met?

6. For each analytical method referenced in this laboratory report package, were results reported for all analytes identified in the method-specific analysis list presented in the Reasonable Confidence Protocol document?

7. Are project-specific matrix spikes and laboratory duplicates included in this data set?

Note: For all questions in which the response was "No," with the exception of question 3b, additional information must be provided in an attached narrative. If the answer to question 1, 3A, or question 3b is "No," the data package does not meet the requirements for "Reasonable Confidence."

Laboratory Narrative page 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 noted at the back of the report.

The data presented in this report is organized by parameter (i.e., VOC, DCOG, etc.). Sample specific Quality Control data (i.e., Surrogate Spike Recovers) are 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 retested due to a failed quality control check, action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-test is designated with an "R" or "RT", respectively. When multiple Batch Quality Control elements are reported (e.g., more than one LC/LD), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory ID, Samples Specific % recovery or RPO 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 MMRRL standards expected 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 section 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 page 2

Pesticides

In reference to question 1:
The associated Pesticide Standards were evaluated for 4,4'-DDD and Endrin insecticides products. The standards were determined to be above the acceptance criteria for Endrin @ 50%; however, the standard was within criteria for 4,4'-DDD @ 50%. The client was contacted and approved proceeding with the analysis.

In reference to question 4:
The sample recoveries for samples AL1234-1 through 6 were below the method acceptance criteria for Diclofenac Supernatant; however, re-extraction could not be performed due to lack of additional samples. The results of the original analysis are reported; however, all associated compounds are considered to have a potentially low bias.
The sample recoveries for samples AL1234-7 through 9 are below the method acceptance criteria for Diclofenac Supernatant and TCDD due to the dilutions required to quantitate the samples. Re-extraction is not required; therefore, the results of the original analysis are reported.
The W0088-34-0 LBLOSLOD recoveries associated with samples AL1234-1 through 9 were below the method acceptance criteria for Endosulfan 250G/20G; however, re-extraction could not be performed due to lack of additional samples. The results of the original analysis are reported; however, all results are considered to have a potentially low bias for this compound.
The W0088-34-0 LSLOSOS2 recoveries associated with samples AL1234-1 through 9 were below the method acceptance criteria for Endosulfan 250G/20G; however, re-extraction could not be performed due to lack of additional samples. The results of the original analysis are reported; however, all results are considered to have a potentially low bias for this compound.
The W0088-34-0 LS2OSOS2 RPD recoveries associated with samples AL1234-1 through 9 is above the method acceptance criteria for 4,4'-DDD. The results of the associated samples are reported.

In reference to question 5:
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 Federal Street Exposure Criteria.
Key QA/QC Concepts

- Endrin/DDT breakdown standard and breakdown products
- Surrogates
- Surrogates diluted out
- Matrix spikes
- Matrix spike duplicates – high RPD
- Reporting limits
- Effect of multiple QC nonconformances

Data Usability Evaluation

- 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 not usable for the intended purpose may be usable in specific, limited situations or for specific purposes.
  - Review issues identified in DQA in relation to the intended use of the analytical data (or an alternative use).
  - The effect of any identified bias can be evaluated using different types of laboratory QC data, the CSM, and multiple lines of evidence.
  - The thought process used to reach the conclusions of the DQA and DUE must be documented.
Use of data:

– Rush project; is redevelopment project viable?

– Questions to answer:
  • Was there a release of pesticides?
  • Are pesticides present at concentrations greater than RDEC and, if so, where?
DUE Worksheet page 2

• Page 2 of the DUE worksheet and Section 4.6 of the 2009 DQA/DUE Guidance provide questions to consider during the DUE.

• The issues for this case study will be addressed through a question and answer discussion format.

Issues to Consider in DUE

The DUE requires consideration of a number of elements when evaluating usability of the data:

– Laboratory QC information
– How the analytical data will be used
– Project-specific DQOs
– CSM
– Multiple lines of evidence
General DUE Questions to Consider

How does the risk of being wrong (based on risk to potential receptors or financial liability) affect your approach to the DUE?

- The environmental professional should be conservative in their overall approach.

- Using multiple lines of evidence, including the CSM, may answer critical questions or strengthen conclusions.
DUE Worksheet Preparation

DUE worksheet page 1

Nonconformances:

– Samples not received at laboratory at 4 °C (+/- 2 °C).
– Reporting Limits greater than RDEC for some samples
– Laboratory Control Samples
– Surrogates
– Matrix Spike/Matrix Spike Duplicates
– Endrin/DDT breakdown
General DUE Questions to Consider

What is the intended use of the analytical data?

Considering the CSM

**CSM:** Former agricultural field, pesticides were applied. All samples were collected as shallow soil samples and were of the same matrix. Mixing and storage of chemicals occurred in the vicinity of the barn.

**Questions:**

Is the presence of pesticides detected in soil samples consistent with the CSM?

The greatest concentrations of pesticides were found in samples S-7, S-8, and S-9. Endrin was reported as “ND” for samples S-1, S-6, and S-10. Are these results consistent with the preliminary CSM?
Endrin Results Close to RDEC.

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

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

Endrin “NDs”

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

**Q:** Endrin was reported as “ND” in samples S-1, S-6, and S-10. Do the nonconformances associated with Endrin affect results that are “ND”?
Endrin “NDs’” (cont’d)

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

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

Endrin Detections at Low Concentration

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

Q: For the samples S-2, S-3, S-4, and S-5 that have detections reported at low concentrations, do these QC nonconformances affect the usability of the results when comparing to the RDEC?

See yellow highlighted nonconformances on the DQA Summary Table.

See pink highlighted nonconformances on the DQA Summary Table.
Endrin Breakdown Products

**QC Nonconformances:**
Endrin breakdown products Endrin Aldehyde (EA) and Endrin Ketone (EK) were detected.

**Q:** EA and EK were detected in samples 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?

Dieldrin Detections Near RDEC

**QC Nonconformances:**
- Surrogate low bias.
- MS/MSD recovery within acceptance criteria for Dieldrin.
- Remember - all samples were the same matrix

**Q:** Dieldrin results for samples S-2 and S-5 are close to the RDEC. Can it be concluded that the results are really below criteria?
Dieldrin Detections Near RDEC (cont’d)

QC Nonconformances:
• Surrogate low bias.
• MS/MSD recovery within acceptance criteria.

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

See blue highlighted nonconformances on the DQA Summary Table.

Dieldrin Detections Near RDEC (cont’d)

QC Nonconformances:
• Surrogate low bias.
• MS/MSD recovery within acceptance criteria.

Q: The matrix spike was performed for sample S-1 only. What if samples S-2 and S-5 were not of the same matrix as S-1 and, therefore, the MS/MSD QC data were not applicable -- Can it be concluded that the results for S-2 and S-5 are really below criteria?

See blue highlighted nonconformances on the DQA Summary Table.
**4,4’-DDT Detections Near RDEC**

**QC Nonconformances:**
- 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 are of the same matrix.

**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 really below criteria? What about sample S-7?

---

**4,4’-DDT Detections << RDEC**

**QC Nonconformances:**
- 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.

**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 really below criteria?
4,4’-DDT “NDs”

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

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

Reporting Limits > RDEC

QC Nonconformances:

Compounds with RLs greater than RDEC:
- Aldrin, Heptachlor, Epoxide, Dieldrin, Chlordane and Toxaphene

Q: Are concentrations of Aldrin, Heptachlor, Epoxide, Dieldrin, Chlordane, and Toxaphene in samples S-7, S-8, and S-9 at concentrations greater than the RDEC?
Temperature Nonconformance

QC Nonconformances:
Samples delivered to laboratory at a temperature greater than 4 °C (± 2 °C). The temperature of samples on arrival at the laboratory was 9 °C.

Pertinent Information: Samples were delivered on ice to the laboratory on the day of collection.

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

Overall Usability of Data Generated During Investigation

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?
Overall Usability of Data Generated During Investigation

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

Significant Data Gaps in the CSM

- Endrin may be present at concentrations greater than the RDEC at sampling locations S-7, S-8, and S-9.
- 4,4’-DDT may be present at concentrations greater than the RDEC at sampling locations S-2, S-4, S-5, and S-9.
- Results for S-7 require further consideration -- decision-making not affected in this case, since Endrin exceeds RDEC at that location.
Data Gaps in the CSM

- Reporting Limits greater than RDEC for Aldrin, Heptachlor Epoxide, Chlorodane, Toxaphene and Dieldrin (S-7, S-8, and S-9). Therefore, these analytes may be present in soil at concentrations below the stated reporting limits, and results cannot be used to evaluate compliance with the RDEC.

- 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.

Neither of these data gaps may be significant due to potential exceedances for Endrin that must be further evaluated and the reported concentrations of Endrin Aldehyde and Endrin Ketone are well below RDEC.

DUE Worksheet page 2
Questions and Answers

Case Study #3

William Flick
Leggette, Brashears & Graham, Inc.
WFLICK@LBGct.com
Case Study #3 – Plating Factory

**Background:** A property used for nickel plating is sold and enters the CT Property Transfer Program. The LEP is retained by the former owner, the certifying party.

**Goal:** The LEP has completed phased investigations and needs to close data gaps to develop a remedial action plan (RAP). At least one area is planned for excavation and ELURs are being considered.

**Pertinent Information:** Map, Results, Criteria, Scenarios
Case Study #3 – Plating Factory

Groundwater Results (ug/l)

<table>
<thead>
<tr>
<th></th>
<th>1,1,1-TCA</th>
<th>Vinyl Chloride</th>
<th>Nickel</th>
<th>Data Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-1</td>
<td>175</td>
<td>ND&lt;8.0</td>
<td>80</td>
<td>QC: MW-1 Elevated RL for Vinyl Chloride</td>
</tr>
<tr>
<td>SWPC</td>
<td>62,000</td>
<td>15,750</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>GWPC</td>
<td>200</td>
<td>2</td>
<td>880</td>
<td></td>
</tr>
<tr>
<td>RVC</td>
<td>20,400</td>
<td>1.6</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>I/CVC</td>
<td>50,000</td>
<td>52</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

Soil Results (mg/kg)

<table>
<thead>
<tr>
<th></th>
<th>1,1,1-TCA</th>
<th>Vinyl Chloride</th>
<th>Total Nickel</th>
<th>Data Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1 1-2 ft. bg</td>
<td>ND &lt; 0.005</td>
<td>ND &lt; 0.005</td>
<td>1,380</td>
<td>QC: Total Nickel Low MS 50%/MSD 55% Recovery</td>
</tr>
<tr>
<td>B-2 1-2 ft. bg</td>
<td>ND &lt; 0.005</td>
<td>0.35</td>
<td>40</td>
<td>QC: Vinyl Chloride High LCS Recovery 154%</td>
</tr>
<tr>
<td>B-3 1-2 ft. bg</td>
<td>550</td>
<td>5.5</td>
<td>15,500</td>
<td></td>
</tr>
<tr>
<td>RDEC</td>
<td>500</td>
<td>0.32</td>
<td>1,400</td>
<td></td>
</tr>
<tr>
<td>I/CDEC</td>
<td>1000</td>
<td>3</td>
<td>7,500</td>
<td></td>
</tr>
<tr>
<td>GA PMC</td>
<td>4</td>
<td>0.1</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>GB PMC</td>
<td>40</td>
<td>1</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>
Case Study #3 – Plating Factory

PROVIDE A STATEMENT REGARDING THE USABILITY OF DATA FOR MW-1, B-1, B-2 & B-3

SCENARIO #1: GB AREA, ELUR PLANNED FOR I/C USE ONLY
SCENARIO #2: GB AREA, RESIDENTIAL USE PLANNED
SCENARIO #3: GA AREA, ELUR PLANNED FOR I/C USE ONLY
Case Study #3 – Plating Factory

Example Responses Regarding Usability:

SCENARIO #1: GB AREA, ELUR PLANNED FOR I/C USE ONLY

- MW-1: VOC and Nickel Detected, Groundwater Criteria Met
- B-1: Nickel MS/MSD Low Rec, meets I/C DEC
- B-2: Vinyl Chloride Det., LCS High Rec, meets I/C DEC
- B-3: Hold time issue VOCs, but reaffirms plan for excavation

SCENARIO #2: GB AREA, RESIDENTIAL USE PLANNED

- MW-1: Vinyl Chloride Reporting Limits > RVC
- B-1: Nickel MS/MSD Low Rec, Requires Consideration for RDEC
- B-2: Vinyl Chloride Det., LCS High Rec, Exceeds RDEC
- B-3: Hold time VOCs, Results > Disposal facility accepting criteria
Case Study #3 – Plating Factory

Example Responses Regarding Usability (continued):

**SCENARIO #3: GA AREA, ELUR PLANNED FOR I/C USE ONLY**

MW-1: Vinyl Chloride RL > GWPC  
B-1: Nickel MS/MSD Low Rec, but meets I/C DEC  
B-2: Vinyl Chloride Det., LCS High Rec, exceeds GA PMC  
B-3: Substances detected assist in excavation closure plan

Questions?
Panel Discussion on DQA/DUE

Peter Hill (DEEP)
Nora Conlon (EPA)
Jim Occhialini (Alpha Analytical)
Tina Clemmey (Ensafe)

Michael Ainsworth (HRP Associates, Inc.)
William Flick (Leggette, Brashears & Graham, Inc.)
Nicole Leja (Eurofins Spectrum Analytical, Inc.)

Summary of Training

Allison Forrest-Laiuppa
DEEP
allison.forrest-Laiuppa@ct.gov
Take away points

• Make good decisions
• Environmental data should be of known and sufficient level of quality
• Documentation should be thorough and succinct
• RCPs provide data of known quality and a good starting point for the review of data quality

Take away points

• Environmental professionals and laboratories work together
• DQA identifies non-conformances with RCP criteria
• DUE determines if data are usable for the intended purpose and considers the project objectives and CSM
• DQA/DUE is done at time data is used and decisions are made – don’t wait until the end
Take away points

• Make sure to request reporting limits below RSR criteria
• Data representativeness issues from sample location and collection method still needs to be considered separately
• There’s not always a stock answer for how to handle DQA issues and their usability

Questions