

# QA/QC Workshop

## Introduction to Data Quality



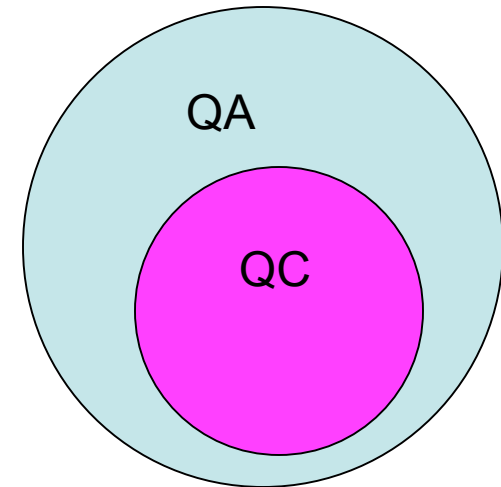
# Workshop Goals

- Basic knowledge of QA/QC
  - Purpose of QA/QC
  - Indicators and methods of derivation
  - Implications for reporting and interpretation
    - Conceptual/example only – actions/responses are project/purpose dependent

# Agenda

- Intro to “data quality”- objectives and terminology – Don Yee, SFEI
- Statistics of the Measurement Process – Ken Osborn, EBMUD
- Organics Analysis by Isotope Dilution on HRMS, LC MS/MS and GC/MS Instrument Platform – Richard Grace, AXYS
- Trace Metals Analysis and Speciation QA/QC - Michelle Briscoe, Brooks Rand
- QA Q&A - Everything You Ever Wanted to Know but were afraid to ask - open panel discussion

# Quality What?



- Quality Assurance (process)
  - All those planned and systematic activities implemented to provide adequate confidence that an entity will fulfill requirements for quality
- Quality Control (product)
  - The operational techniques and activities that are used to fulfill requirements for quality

# Need for QA/QC

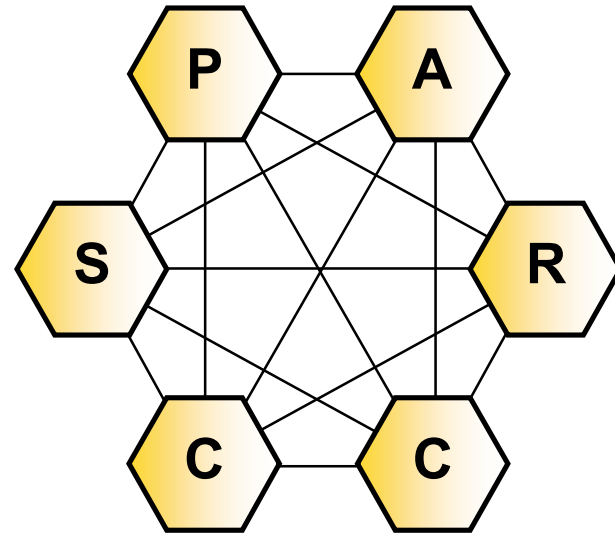
- Process for assuring and/or evaluating the suitability of collected data for a particular purpose
- Without it, too many questions
  - What/where/how measured?
  - Is that number “right”?
  - ...+101 other doubts...



# Data Quality Indicators (DQIs)

aka Measurement Quality Indicators/Objectives (MQIs/MQOs)

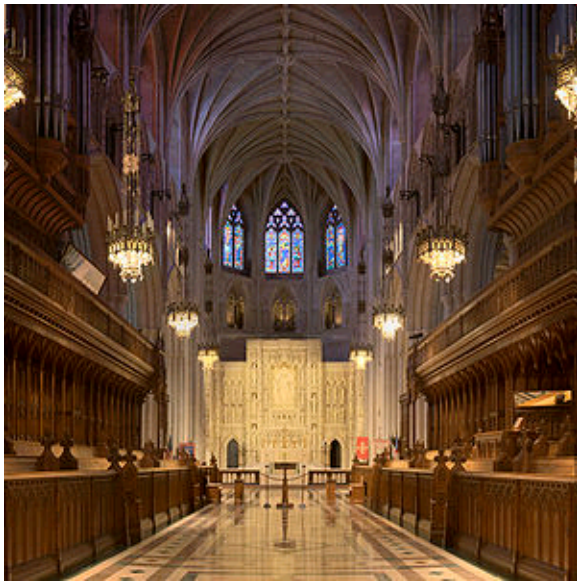
- Sensitivity
- Precision
- Accuracy/Bias
- Representativeness
- Completeness
- Comparability



Needed to answer some of the 101 Qs

# Sensitivity

- If a pin dropped, would you hear it?



- Depends on background noise
- “Reporting limit” = what you call  $>$ noise

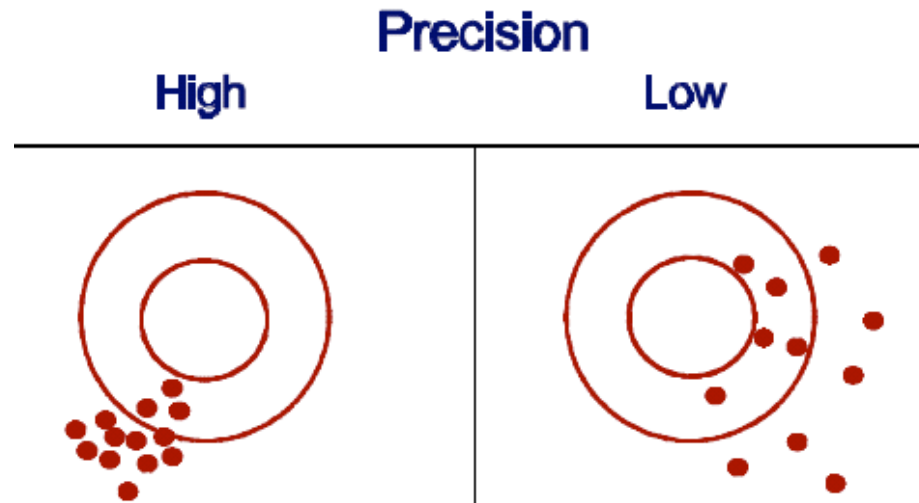
# What About Blanks?

- Blank = measurement of non-sample
- Not explicit in SPARCC concept
- Part of “background noise”, sensitivity
  - Blank “noise” could be random or systematic
  - In theory accounted for by reporting limit (RL)
    - But sometimes blank >RL (especially if sporadic)
    - May be OK if << regular samples



# Precision

Precise = repeatable (with the same result)

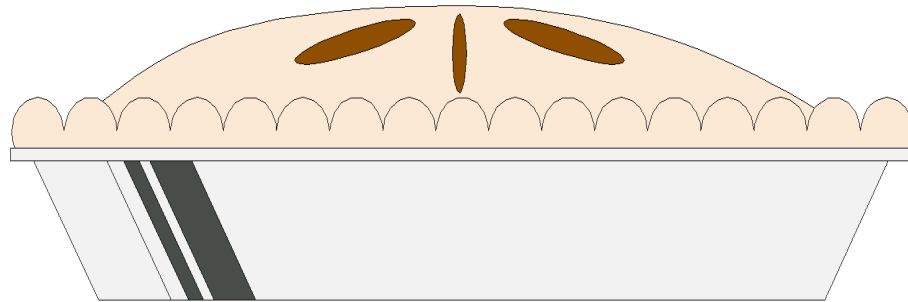


No assurance it's right, just consistent



# Representativeness

- How typical of your target is your sample?



- If sample too small, too few, too close together, cherry pie = cherry?

# Completeness

- How many valid measurements obtained versus the number desired or expected?
  - Too few and the sample set unlikely to be representative
  - Failures an indication of need to modify sampling/handling/analysis process, or expectations
  - Can be for individual analytes or for groups (e.g. when analytes need to be compared to each other)

# Comparability

- Qualitative determination that two or more data sets may contribute to a common analysis
  - Performance on other DQIs may form the basis for judgment- similar detection limits, recoveries, reported range, etc.
  - Narrative descriptions also important
    - Details of sampling, handling, preparation, storage, and/or analytical methodologies

# DQI, Meet Reality

- Ideally, detection in all samples, no bias, exact precision, all samples collected, using “correct” methods
- What you want  $\neq$  what you can get
  - DQI targets often tempered by what is routinely achievable by lab(s) (reality)
  - Or what you can afford (more reality-detection limits especially \$ sensitive)

# What About DQI “Failures”?

- Typical options include
  - Resample and/or reanalyze
  - Flag it- OK for some purposes
  - Censor it- more doubt than certainty
- What you do depends on project needs and priorities
  - Budget, indecision/uncertainty tolerance, built in safety factors

# Data Quality Objectives

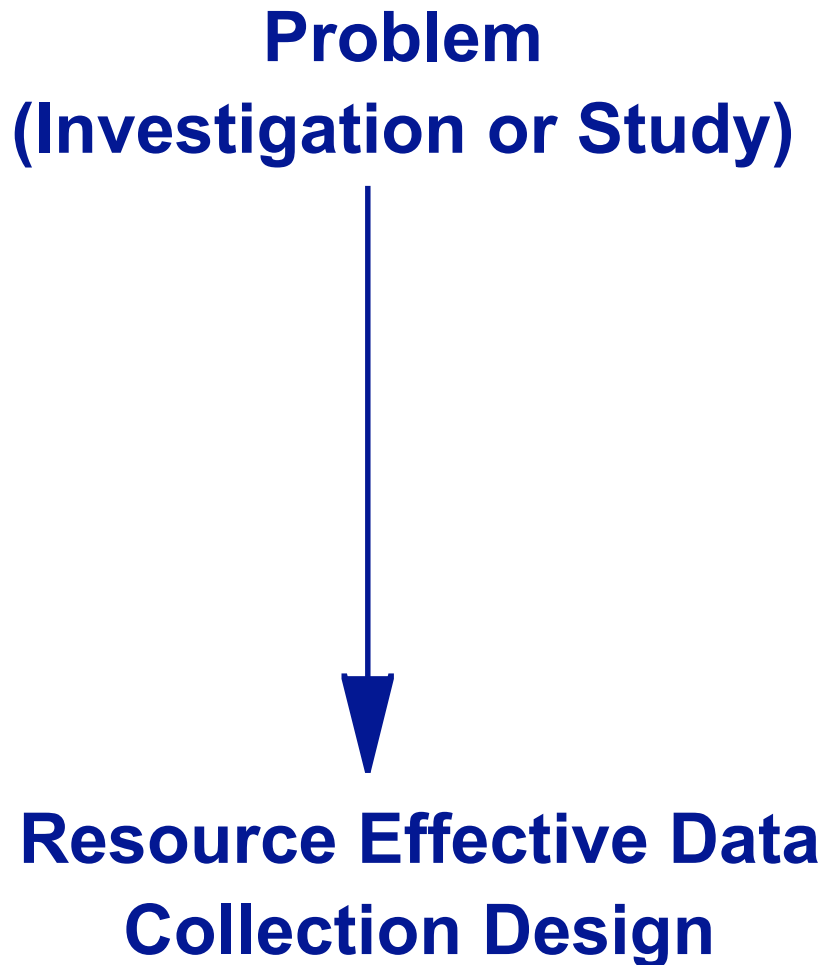
- DQOs help establish
  - What do you need?
  - Why do you need it?
  - How will you use it?
  - What is your tolerance for errors?
    - DQIs only address what is your error?





# The DQO Process

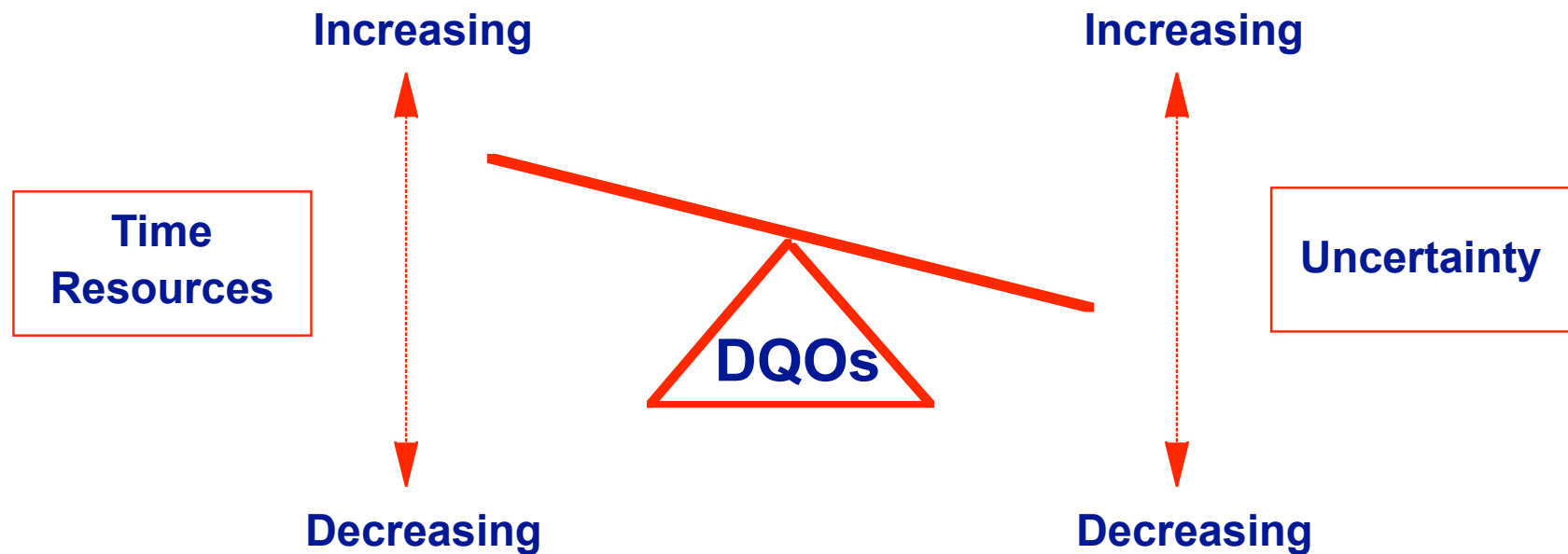
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1. State the Problem.
2. Identify the Decision.
3. Identify the Inputs to the Decision.
4. Define the Boundaries of the Study.
5. Develop a Decision Rule.
6. Specify Tolerable Limits on Decision Errors.
7. Optimize the Design.



# DQOs Strike a Balance



# DQIs in DQOs

- DQIs provide clues to help determine if DQO needs are met
  - Step 6, “Specify Tolerable Limits on Decision Errors” late in the process
  - Post facto evaluation possible, but inefficient
    - wrong/insufficient data, too loose/stringent
- For now assume our desired DQIs are known/appropriate
  - DQO development 6 hr course for EPA

# Too Much Time?

- EPA Quality Systems training materials  
<http://www.epa.gov/quality/training.html>
- Courses include
  - Assessing Quality Systems
  - Detecting Improper Laboratory Practices
  - Interpreting Monitoring Data
  - Interpreting Multivariate Analysis
  - Introduction to Data Quality Assessment
  - Introduction to Data Quality Indicators
  - Introduction to Data Quality Objectives
  - Introduction to EPA Quality System Requirements
  - Introduction to Quality Assurance Project Plans
  - Introduction to Quality Management Plans
  - Overview of the EPA Quality System