Developing Quality Assurance Project Plans using Data Quality Objectives and other planning tools

Introductions

Agenda

I. Developing a QAPP

II. Systematic Planning using Data Quality Objectives

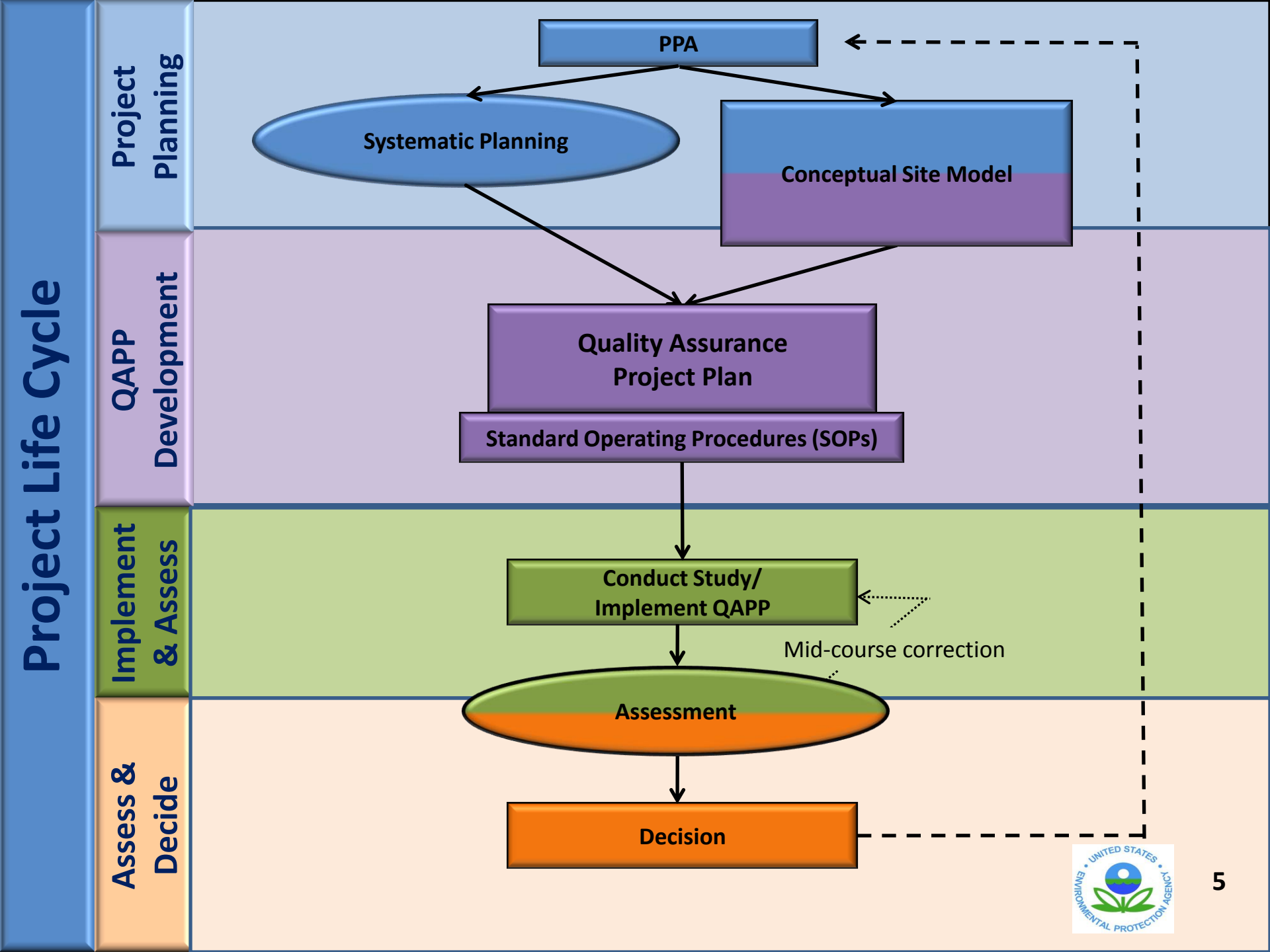
III. Data Quality Indicators

IV. Project Assessment

V. Data [Quality] Assessment

VI. Summary of Training

Developing Quality Assurance Project Pans


Project Life Cycle
Project Planning
QAPP Development
Implement & Assess
Assess & Decide
PPA
Systematic Planning
Conceptual Site Model
Quality Assurance Project Plan
Standard Operating Procedures (SOPs)
Conduct Study/ Implement QAPP
Mid-course correction
Assessment
Decision

QAPP Project Management Elements

- A1 Title and Approval Sheet
- A2 Table of Contents
- A3 Distribution List
- A4 Project/Task Organization
- A5 Problem Definition/Background
- A6 Project/Task Description
- A7 Quality Objectives and Criteria
- A8 Special Training/Certification
- A9 Documents and Records

QAPP Data Generation and Acquisition Elements

- B1 Sampling Process Design (Experimental Design)
- B2 Sampling Methods
- B3 Sample Handling and Custody
- B4 Analytical Methods
- B5 Quality Control
- B6 Instrument/Equipment Testing, Inspection, and Maintenance
- B7 Instrument/Equipment Calibration and Frequency
- B8 Inspection/Acceptance of Supplies and Consumables
- B9 Non-direct Measurements
- B10 Data Management

QAPP Project Assessment and Oversight Elements

- Assessment/Oversight activities done to see if project is conducted per the QAPP
- C1 Assessments and Response Actions
- C2 Reports to Management

QAPP Data Verification/Validation and Usability Elements

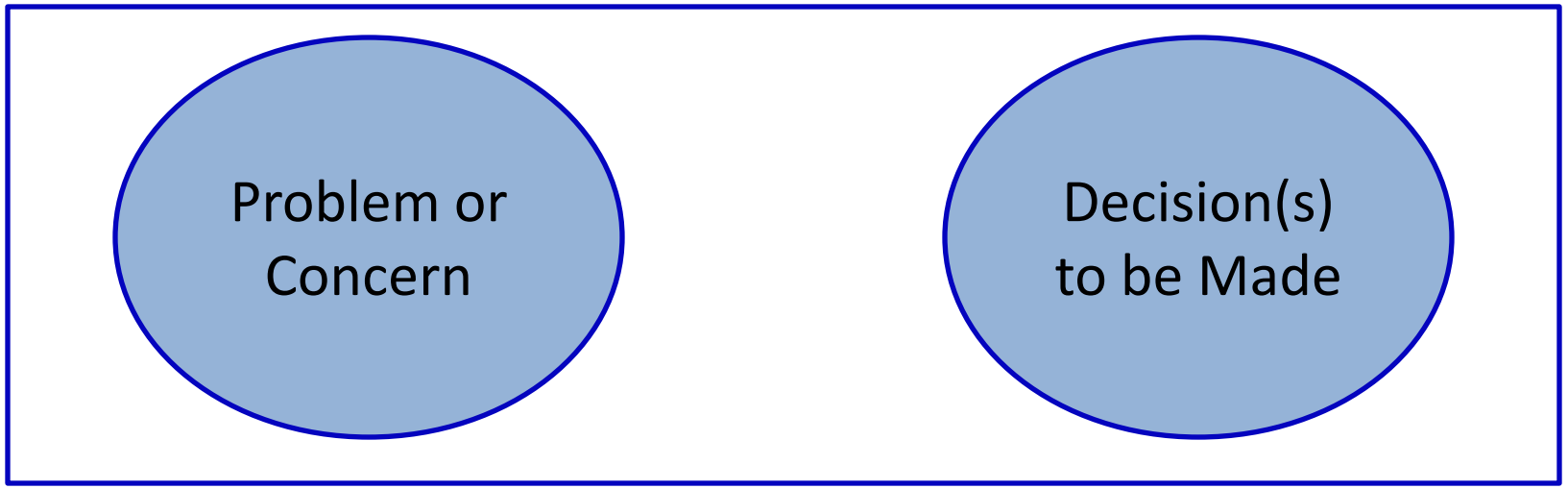
- D1 Data Review, Verification, and Validation
- D2 Verification and Validation Methods
- D3 Reconciliation with User Requirements
  - Identification of data to be evaluated
  - Evaluation methods and criteria
  - Roles and responsibilities for evaluation
  - How limitations on data use will be reported
  - How results of assessments and data evaluations may be considered in decision-making

Systematic Planning–

An Integrated Approach to Project Planning for Defensible Decision-Making

Mary Goldade
EPA Region 8

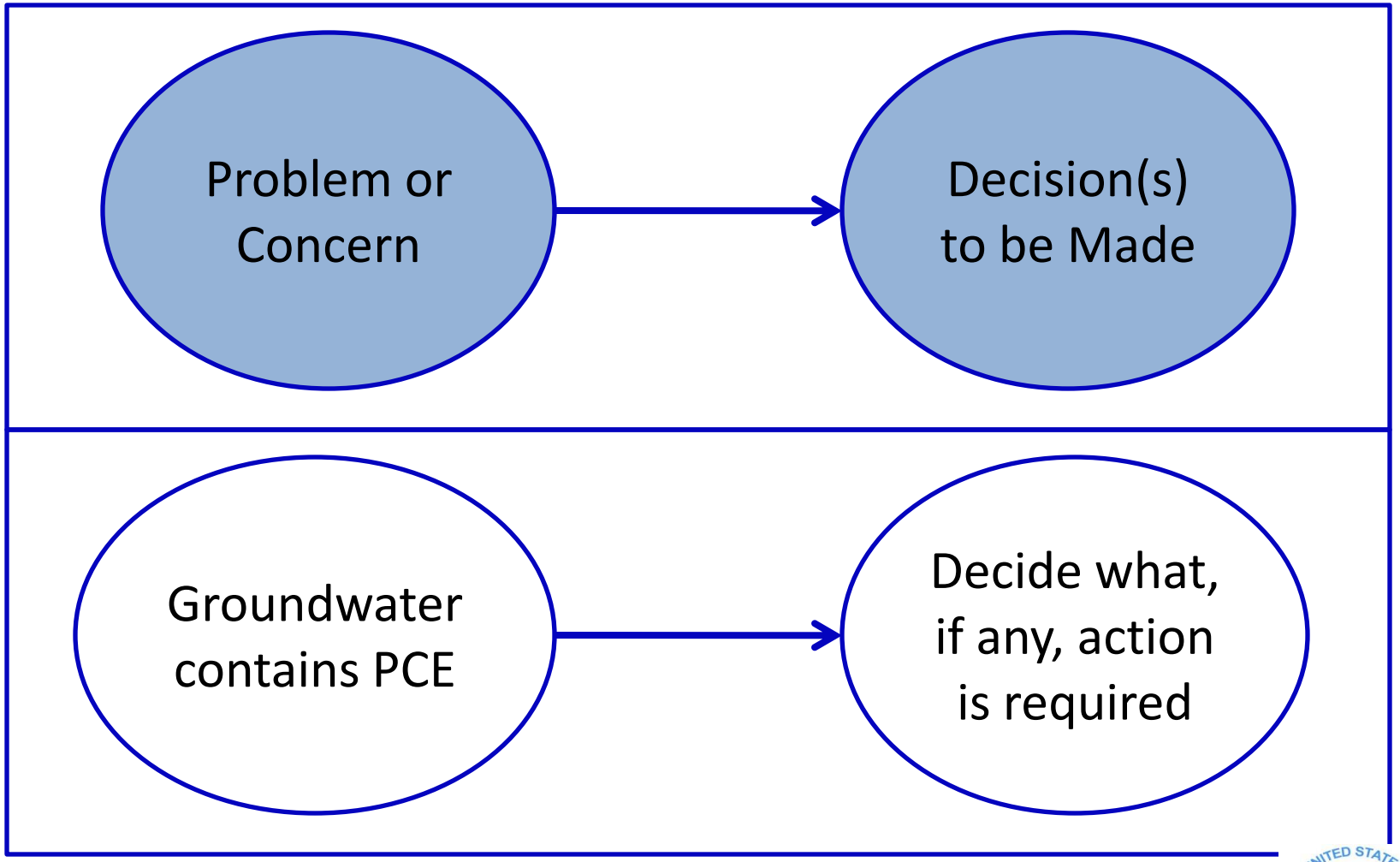
Systematic Planning:



Always has the End Use Goal in Mind

Be thinking about the end use at the beginning & throughout the project life

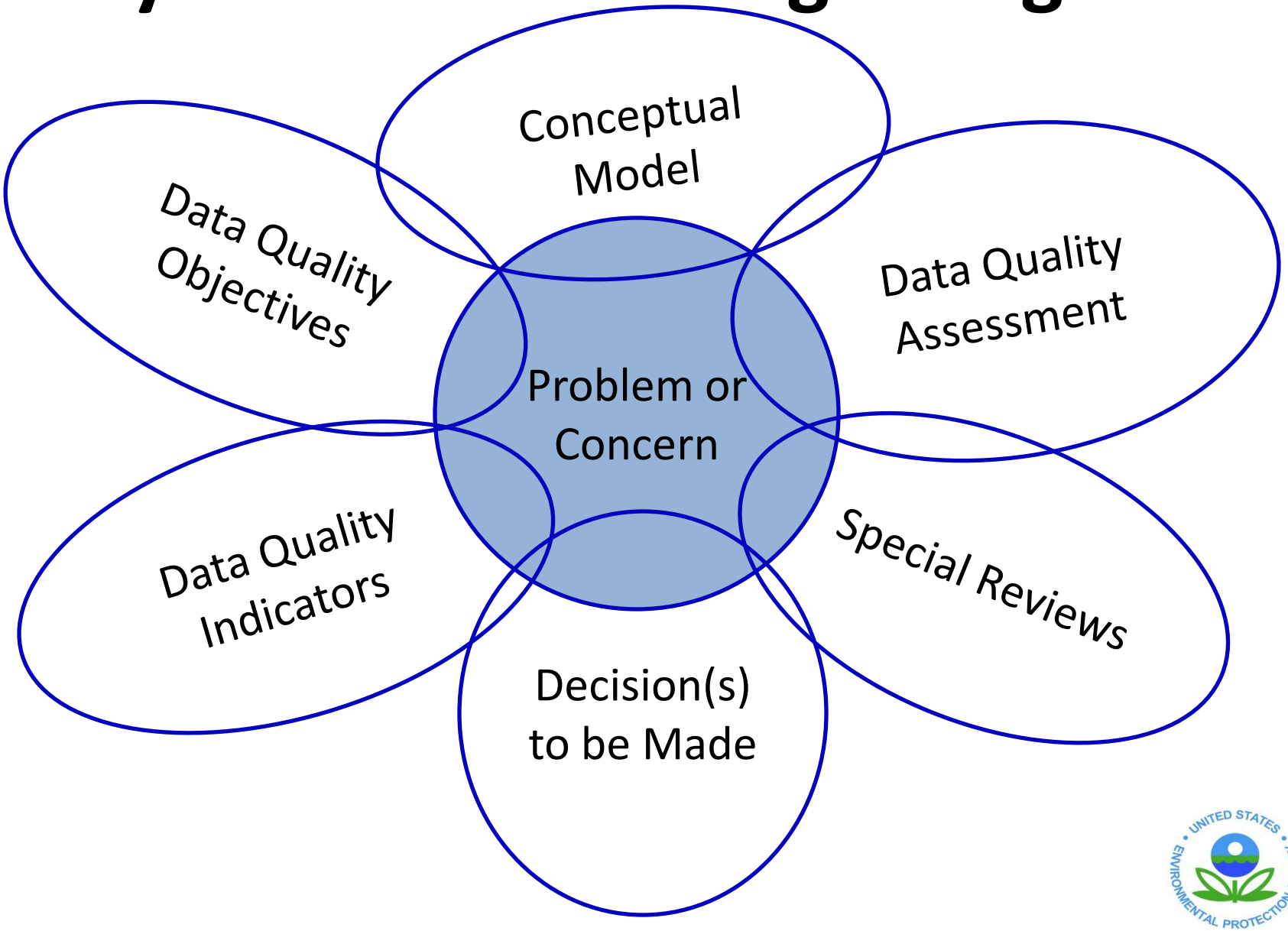
Project Planning:



Systematic Planning for Environmental Data Collection

- Program & Resource Planning
- Data Quality Objective (DQO) Development
- Quality Assurance Project Plan (QAPP)
- Data Quality Assessment (DQA)
- Reporting Requirements
- Special Reviews
  - Peer Review
  - Human Subjects Research Review

Systematic Planning: Integrates



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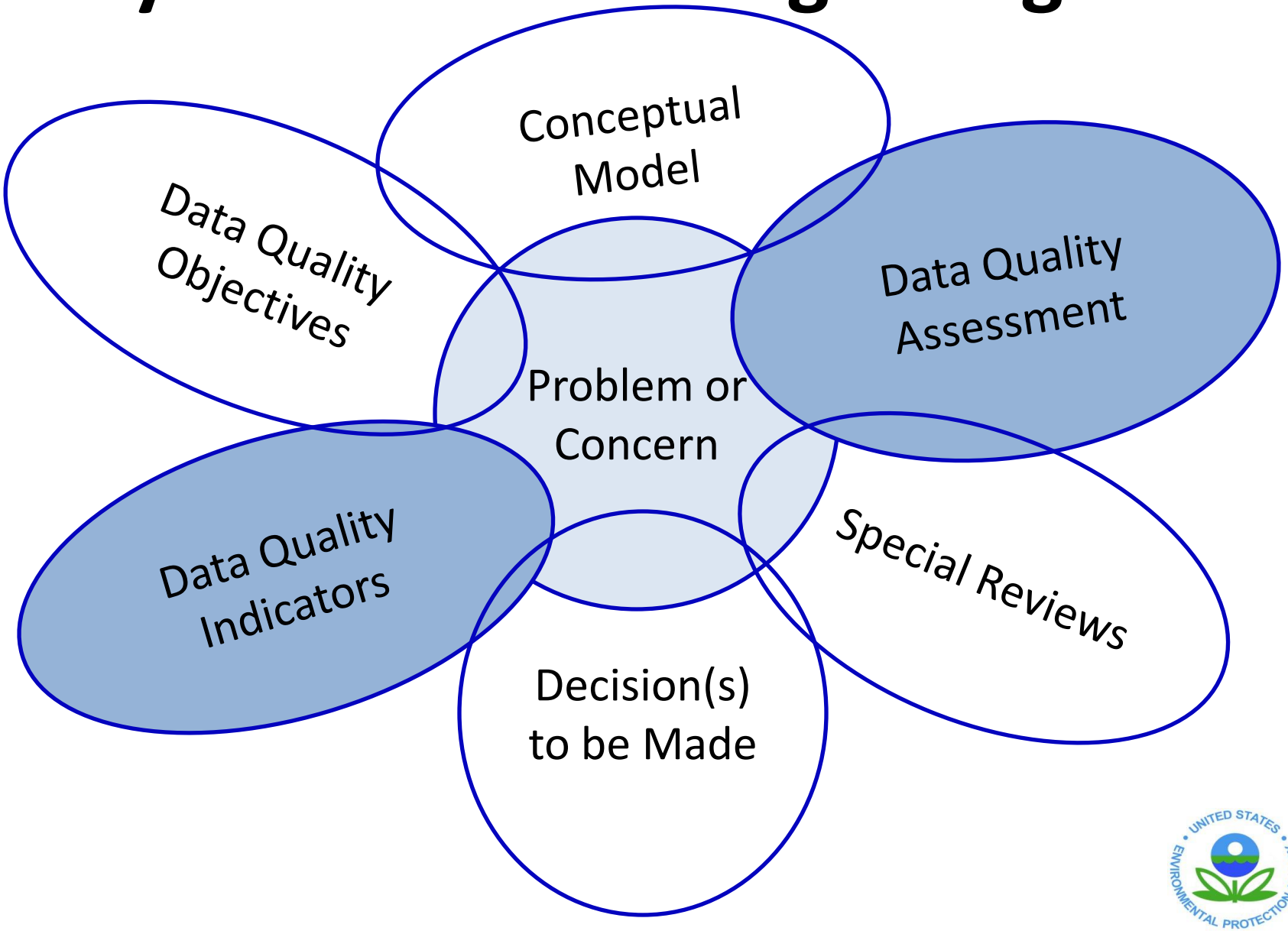
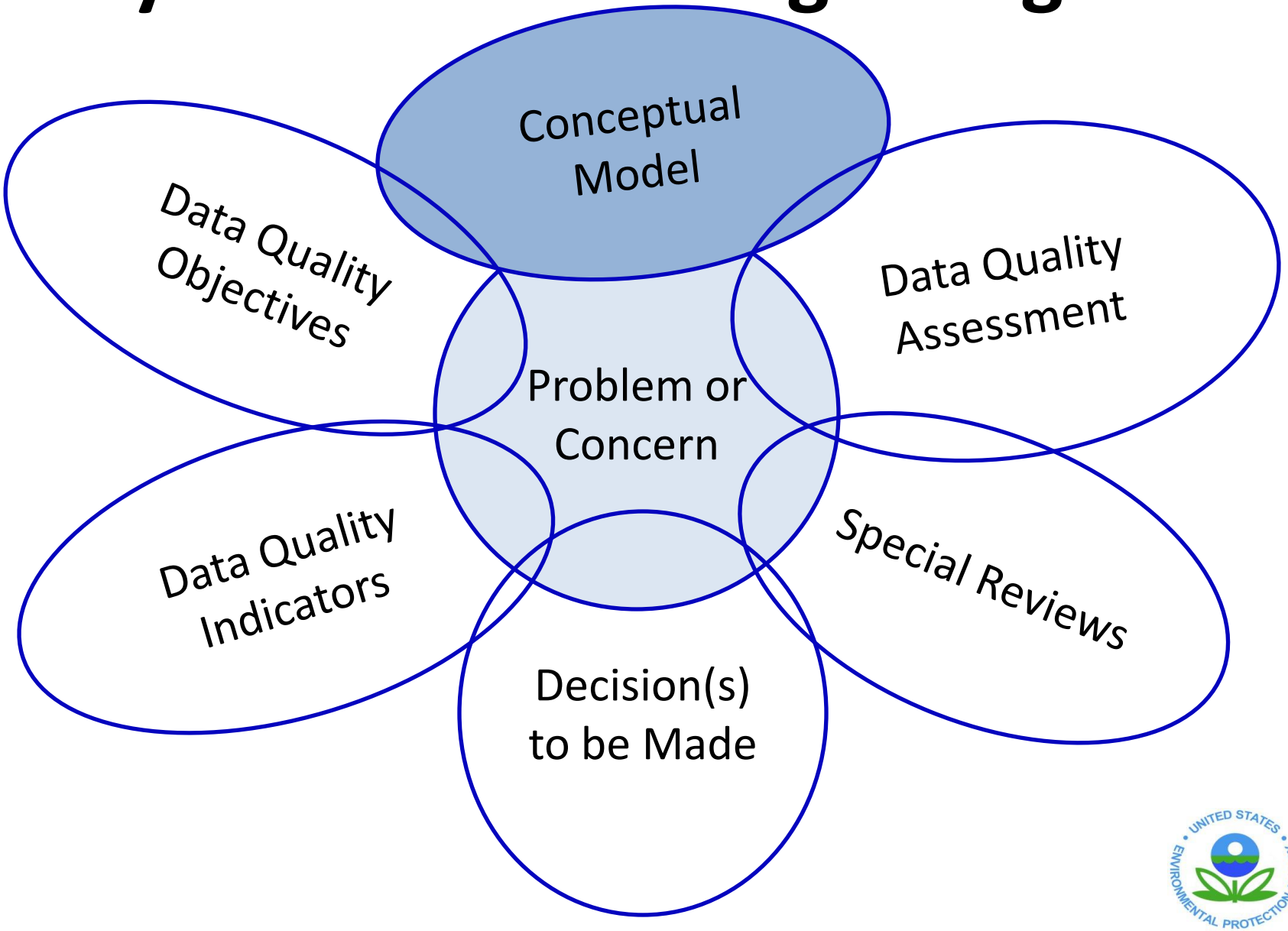


Systematic Planning: Integrates



Conceptual Model

- Conceptual Site Model (CSM) is a tool used to help describe or visualize environmental conditions at your site (not just for risk assessments)

- Describes known or potential:
  - Sources of contamination
  - Media that are contaminated or may become contaminated
  - Contaminants of concern
  - Movement of contamination through the environment
  - Exposure scenarios/Receptors (human or ecological)
  - Potential Benchmarks or Action Levels (Target Levels)

Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4 February 2006)

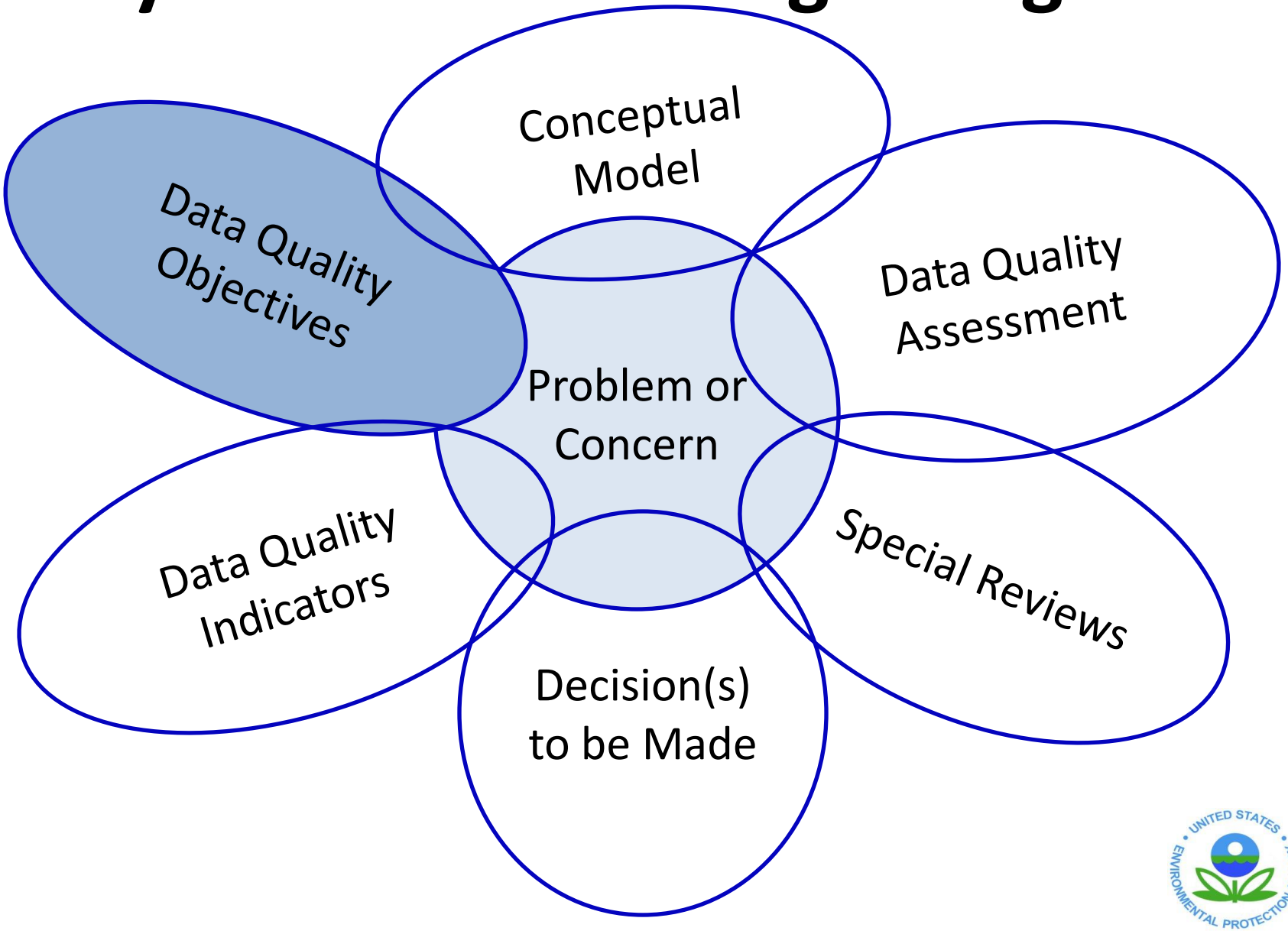
Conceptual Model Purpose

- Tells the **pictorial story** of environmental conditions onsite and nearby
- Identifies data needs and gaps that are customized to the regional, geographical and regulatory conditions
- Supports the rationale for selection of sampling locations
- Establishes requirements for background (off-site) and on-site characterization
- Serves as a Communication Tool to describe site conditions
- At any stage in your work, refines your understanding of the site conditions (initial site characterization, and selection of remedial alternatives, post-remediation monitoring, etc.)

Initial Target Level(s)

- Numerical values included in the QAPP to define the laboratory detection limits needed to make decisions at your site
- Initial Target Level(s) may be:
  - Technology limits (e.g., analytical detection limits)
  - Risk-based concentrations or screening levels
  - Regulatory standards (Local, State or Federal)
  - Regulatory criteria (MCLs, tribal, etc.)
  - Other?
  - or a combination of all of the above
- Based upon CSM information (receptors, media and contaminants of concern)

Systematic Planning: Integrates



Data Quality Objectives

- DQO process is the Agency's approach for:
  - decision-making (compliance or cleanup)
  - estimation (contaminant concentration levels)

- Proper planning:
  - Efficient appropriation of resources (avoids rework, re-sampling)
  - Ensures maximum quality, objectivity, utility & integrity of data

Benefits of Applying the DQO Process

- Well-documented procedures & requirements for data collection and evaluation
- Sound & comprehensive QA Project Plans
- Early identification of the success of the sampling design, data collection and data evaluation approach (or need for mid-course correction)

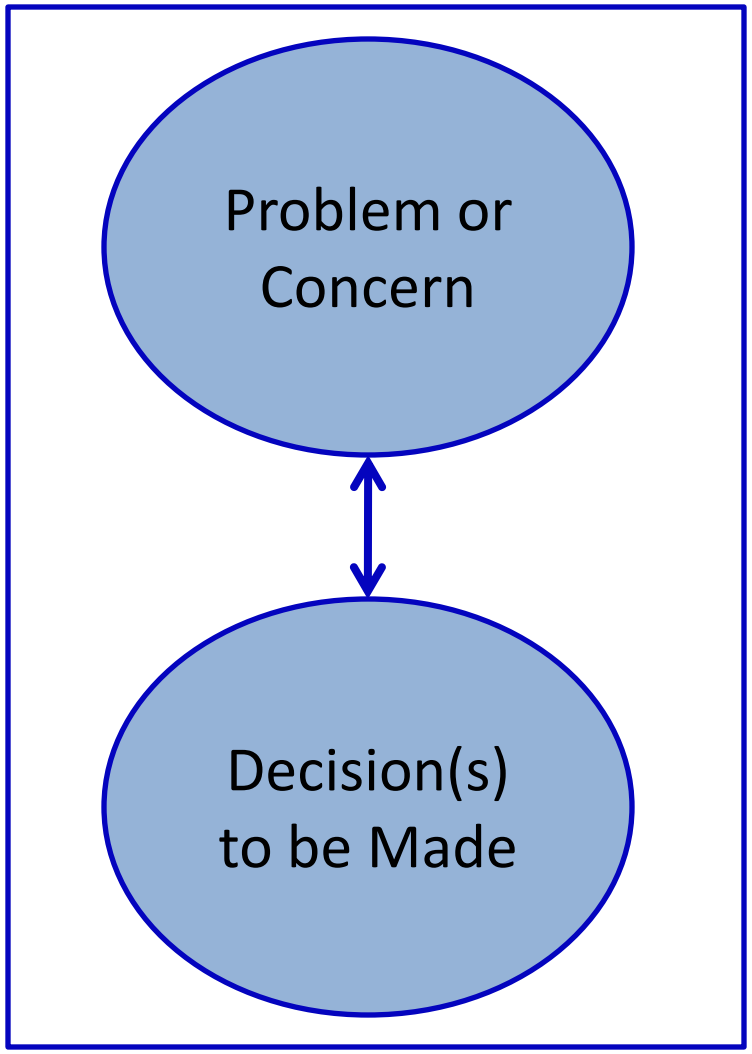
Data Quality Objective Process (EPA QA/G-4 2006)

1. State the Problem
2. Identify the Goal of the Study
3. Identify Information Inputs
4. Define the Boundaries of the Study
5. Develop the Analytic Approach
6. Specify Performance or Acceptance Criteria
7. Develop the Plan for Obtaining Data

DQO Planning Teams

- Enables Data Users and Technical Experts to collaborate collectively to specify their needs:
  - Field samplers
  - Laboratory personnel who will be conducting testing
  - Scientific Experts (e.g., chemists, toxicologists, geologists, hydrologists)
  - Data Users and Decision-makers (e.g., project manager, stakeholders)

Systematic Planning:



Revisits the
End Use Goal…

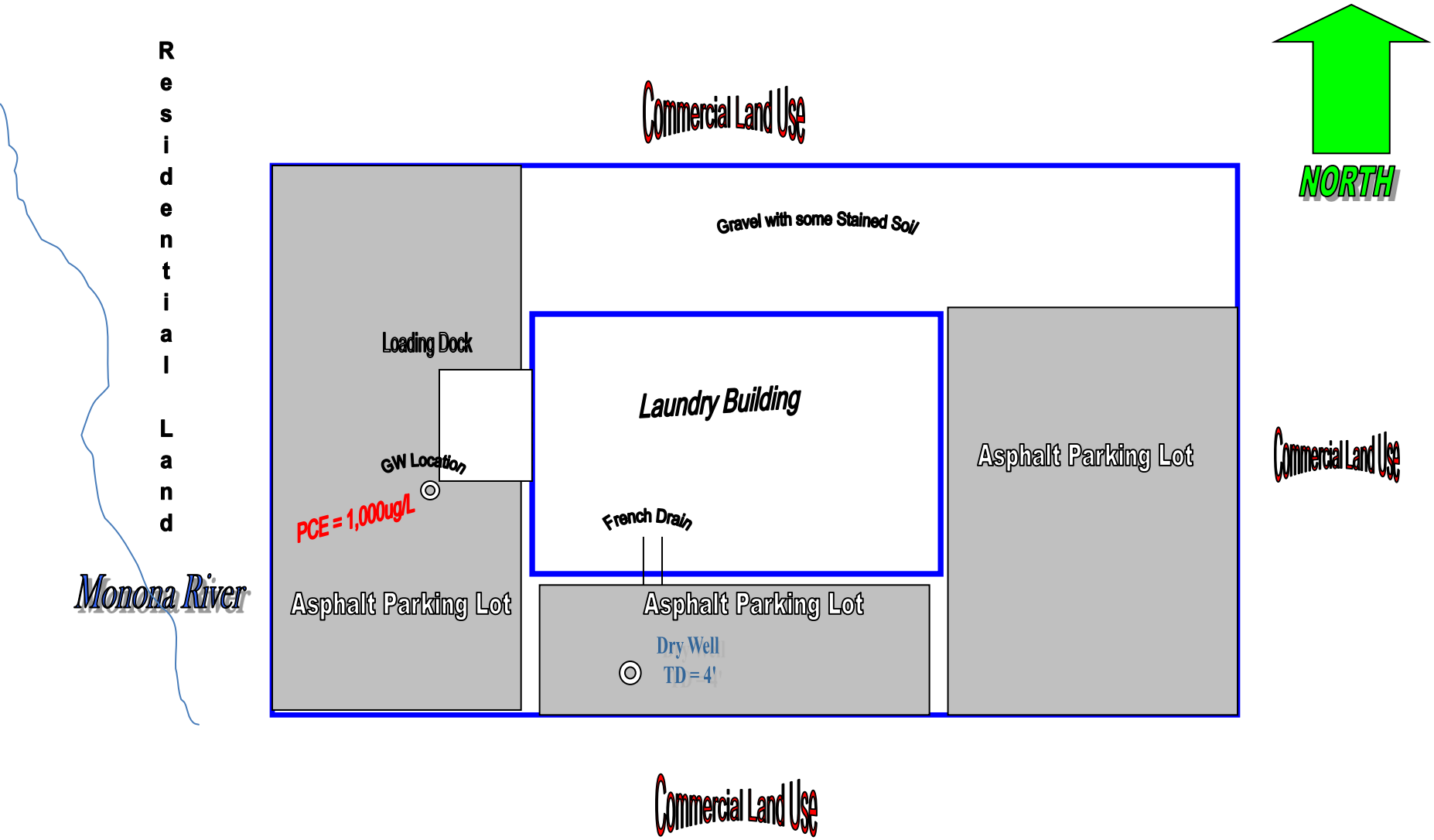
- project development
- implementation
- as results come in
- data assessment
- reporting

…throughout the Project Life Cycle

Systematic Planning Case Study

Monona River Commercial Site

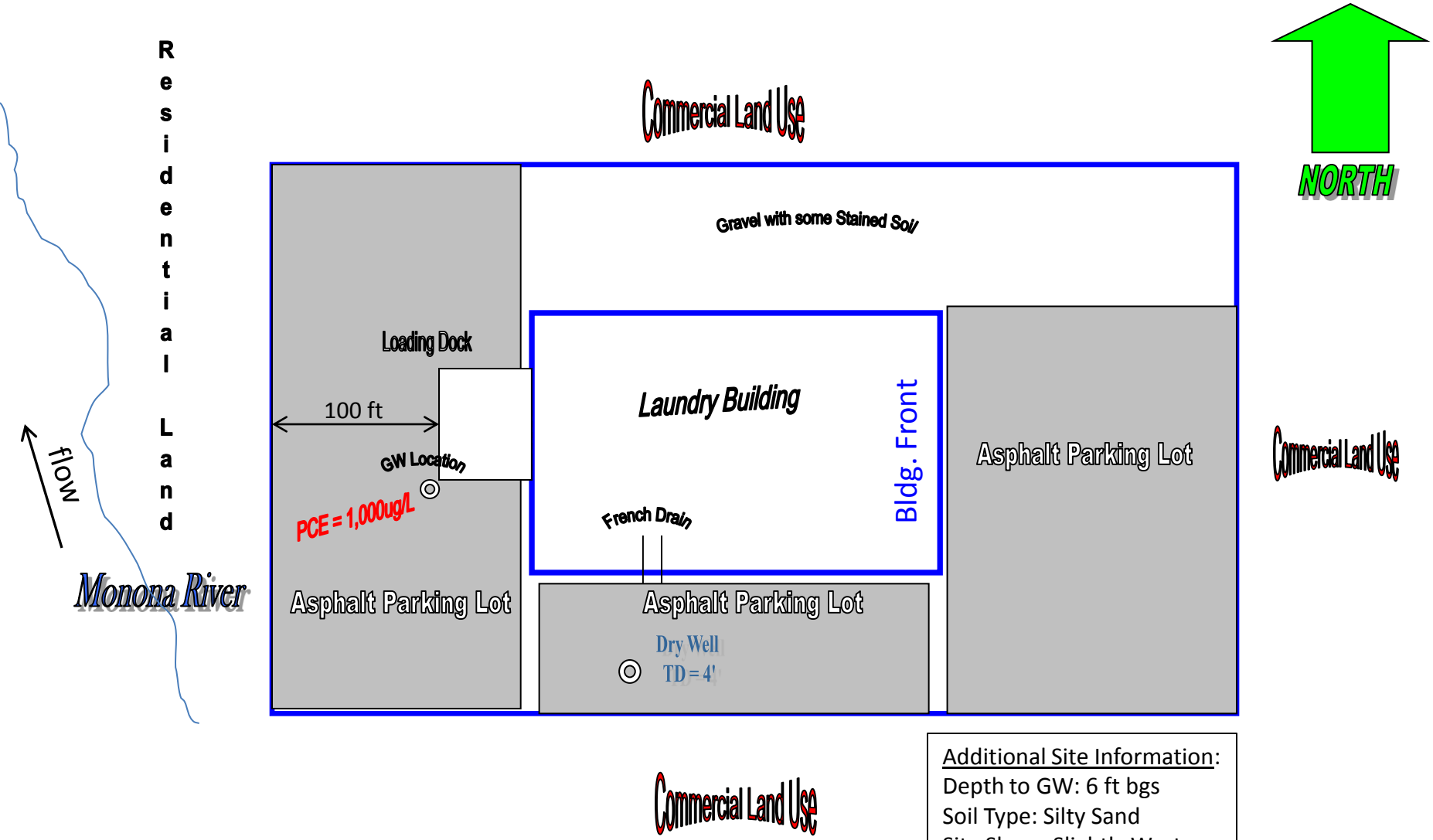
Monona River Commercial Site



Developing a Conceptual Model

- ❑ Start with a map of the site
- ❑ Use CSM Worksheet to describe site conditions
- ❑ Create a CSM
- ❑ Use the CSM to develop Initial Target Levels
- ❑ Include CSM and Initial Target Levels in QAPP

Monona River Commercial Site



Additional Site Information:
Depth to GW: 6 ft bgs
Soil Type: Silty Sand
Site Slope: Slightly West

Conceptual Site Model Worksheet*

**This document and other QA references may be found at the QA website (http://www.epa.gov/region8/qa/)*

Conceptual Site Model Worksheet

Known or Potential Sources and/or Activities	Known or Potential Contamination	Movement of Contaminant	Known or Potentially Impacted Media	Potential Exposure Pathways	Potential Receptors	Action Level(s) (Technology, Regulatory, Screening, Human Health, Water Quality, Ecological, etc.)

Developed by: Mary Goldade, EPA Region 8

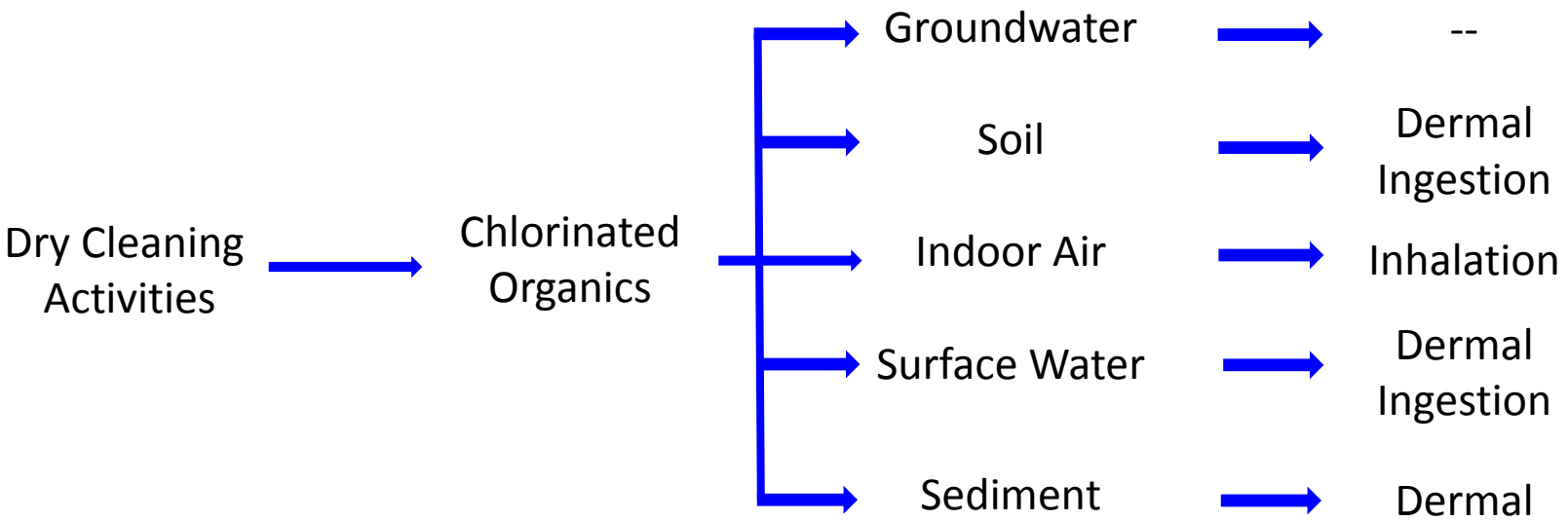
nion: 11/2/11

For demonstration purposes only

CSM Worksheet: Monona River Site

Known or Potential Sources and/or Activities	Known or Potential Contamination	Known or Potentially Impacted Media	Movement of Contaminant	Potential Exposure Scenario(s)	Potential Receptors
Dry Cleaning Activities	Organic Solvents (PCE & Degredation Products)	Groundwater	from Contaminated Soil from Waste Source	Ingestion	Human Water Consumption (Adult & Child)
		Soil	from Waste Source from Windblown Contaminated Dust	Uptake/Ingestion/Direct Contact	Ecological (Plant, Terrestrial Life)
		Surface Water	Recharge/Feed from Groundwater from Site Run-off	Ingestion/Direct Contact	Ecological (Plant, Aquatic Life)
		Sediment	from Site Run-off from River Water	Ingestion/Direct Contact	Ecological (Plant, Aquatic Life)
		Aquatic Life	from River Water/Sediment to Fish	Ingestion	Human Fish Consumption (Adult & Child)
		Indoor Air (Vapor Intrusion)	from Groundwater/Soil	Inhalation	Human Breathing (Adult & Child)
Chrome Plating Activities	Chromium (Total, Trivalent or Hexavalent?) Nickel? Other Metals? Degreasing Organic Solvents?	Groundwater	from Contaminated Soil from Waste Source	Ingestion	Human Water Consumption (Adult & Child)
		Soil	from Waste Source from Windblown Contaminated Dust	Uptake/Ingestion/Direct Contact	Ecological (Plant, Terrestrial Life)
		Surface Water	Recharge/Feed from Groundwater from Site Run-off	Ingestion/Direct Contact	Ecological (Plant, Aquatic Life)
		Sediment	from Site Run-off from River Water	Ingestion/Direct Contact	Ecological (Plant, Aquatic Life)
		Aquatic Life	from River Water/Sediment to Fish	Ingestion	Human Fish Consumption (Adult & Child)
		Indoor Air (Vapor Intrusion)	from Groundwater/Soil	Inhalation	Human Breathing (Adult & Child)
Soil Staining	Gas or Diesel Range Organics? Other Degreasing Organic Solvents?	Groundwater	from Contaminated Soil from Waste Source	Ingestion	Human Water Consumption (Adult & Child)
		Soil	from Waste Source from Windblown Contaminated Dust	Uptake/Ingestion/Direct Contact	Ecological (Plant, Terrestrial Life)
		Surface Water	Recharge/Feed from Groundwater from Site Run-off	Ingestion/Direct Contact	Ecological (Plant, Aquatic Life)
		Sediment	from Site Run-off from River Water	Ingestion/Direct Contact	Ecological (Plant, Aquatic Life)
		Indoor Air (Vapor Intrusion)	from Groundwater/Soil	Inhalation	Human Breathing (Adult & Child)

Partial Monona River Site Conceptual Model
Dry Cleaning Activities



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Developing QAPPs 5/10/2012

Developing the Data Quality Objectives

DQOs: 7-Step Process

1. State the Problem
2. Identify the Goal of the Study
3. Identify Information Inputs
4. Define the Boundaries of the Study
5. Develop the Analytic Approach
6. Specify Performance or Acceptance Criteria
7. Develop the Plan for Obtaining Data

DQO Step 1:
State the Problem

DQO Step 1

a. **Describe the problem to be addressed**

b. Identify leader & members of the planning team, including decision-makers and/or principal data users

c. **Develop a conceptual model of the environmental hazard(s) being investigated**

d. Preliminary identification of data needed

e. **Discuss alternative approaches to investigation in solving the problem**

f. Determine Resources--budget, personnel & schedule

DQO Process: Key Question about Problem Statement

Do you have a Decision to Make?

Decision Problem

OR

Are you Estimating/Characterizing Concentration?

Estimation Problem

DQO Step 1: Example Problem Statement

Estimation Problem

The source and the extent of PCE contamination in groundwater is currently unknown.

Additionally, there is no further information about current groundwater conditions or whether other Site contamination is contributing to groundwater conditions.

Decision Problem

It is unknown whether and to what extent Site activities have impacted the groundwater and whether the groundwater requires a cleanup or other action.

DQO Step 2: Identify the Goals of the Study

DQO Step 2

a. **Identify principal study question(s)**

b. **A list of potential outcomes or actions that result from answering the principal study question(s)**

c. **<u>Decision Statement</u>: Develop a list of decision statements that address the study question(s)**

   <u>Estimation Statement</u>: Develop a list of estimation statements that address the study question(s)

DQO Step 2: Example Principal Study Questions

Estimation Problem

1. What is the distribution of groundwater contamination over space and time (e.g., nature and extent of contamination)?

2. Are Site conditions contributing to the characteristics (e.g., contamination) of the groundwater?

Decision Problem

1. Do the contaminant levels in the groundwater exceed acceptable levels? If so,
   a) Are contaminant levels in groundwater significantly above background levels?
   b) Have conditions at the Site contributed to the impacted groundwater?

2. Is the groundwater safe for human and ecological receptors and/or does it require cleanup?

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DQO Step 2: Example Decision/Estimation Statements

Estimation Problem

1. Determine the nature and extent of groundwater contamination over space and time.
2. Characterize the chemical and physical conditions onsite and determine whether any transport mechanisms or pathways exist for contamination to reach the groundwater.

Decision Problem

1. Determine whether the contaminants of concern in groundwater exceed acceptable levels (e.g., maximum contaminant levels (MCL) PCE=5µg/L; other action limit or risk level).

2. Determine whether and the locations where cleanup or other action is required.

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DQO Step 3: Identify the Information Inputs

DQO Step 3

a. A list of environmental characteristics that will resolve the decision or estimate potential sources for the desired information inputs
b. **The type of information needed to meet performance or acceptance criteria [**Iterates with DQO Steps 5 & 6]
c. Information on the appropriate sampling and analysis methods

DQO Step 3: Info Needed to Meet Performance Criteria

Estimation Problem

- Detection Limits
  - Based on "Anticipated" Action Level (Step 5)
- Data Quality Indicators (Step 6)
  - Field & Lab QC Requirements
  - PARCCS

Decision Problem

- Detection Limits
  - Based on Action Level (Step 5)
- Data Quality Indicators (Step 6)
  - Field & Lab QC Requirements
  - PARCCS

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DQO Step 4: Define the Boundaries of the Study

DQO Step 4

a. Specify target population
b. Specify the sampling unit
c. Define spatial & temporal limits/boundaries
d. Timeframe appropriate for collecting the environmental data
e. Timeframe for making the decision or estimate
f. Define the appropriate scale for decision-making or estimation (risk, technological considerations, previous site knowledge, financial)

DQO Step 5: Define the Analytic Approach

DQO Step 5

a. Define the population parameter (e.g., mean, median, percentile, etc.) for making decisions or estimates

b. Develop logic for drawing conclusions from findings (Decision Rule):

<u>Decision Problem</u>: Specify the Action Level & define "if, then, else" action to be taken

<u>Estimation Problem</u>: specify the estimator to be used (mean, central tendency, etc.)

DQO Step 6: Specify Performance or Acceptance Criteria

DQO Step 6

a. **<u>Decision Problem</u>: Specify the decision rule as a statistical hypothesis test, examine the consequences of making incorrect decision from the test, and place acceptable limits on the likelihood of making decision errors**

   <u>Estimation Problem</u>: Specify acceptable limits on estimation uncertainty

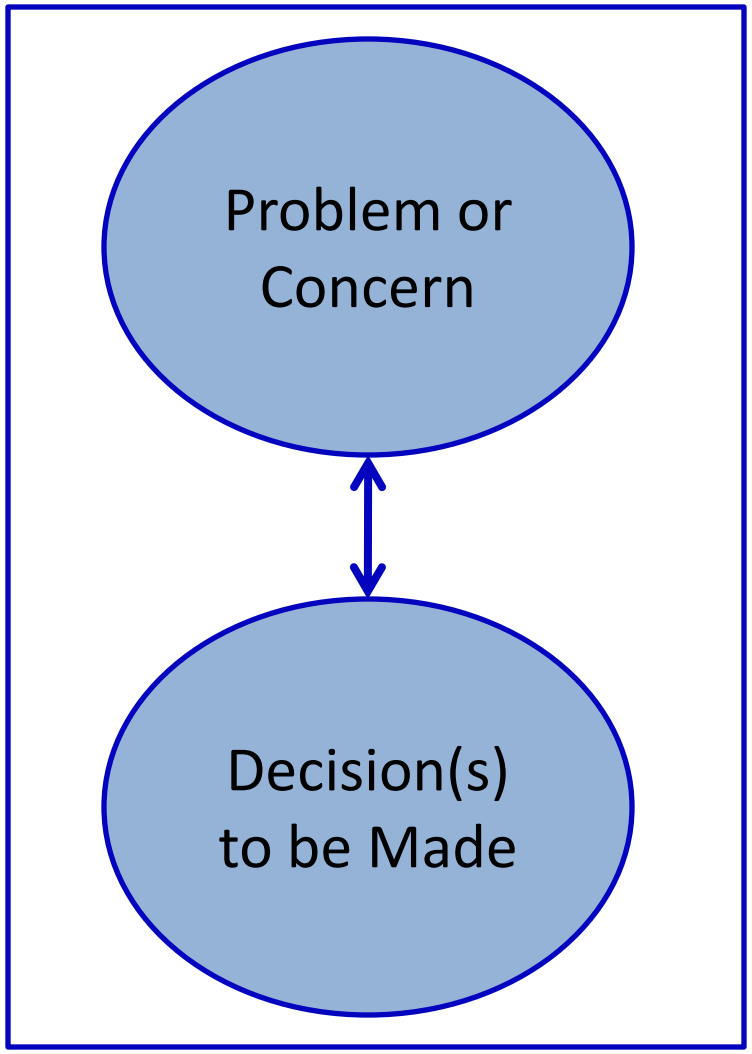
DQO Step 7: Develop the Plan for Obtaining Data

DQO Step 7

a. **Select the resource-efficient sampling and analysis plan that meets the performance criteria**

ALL STEPS IN DQO PROCESS ARE ITERATIVE

Systematic Planning:



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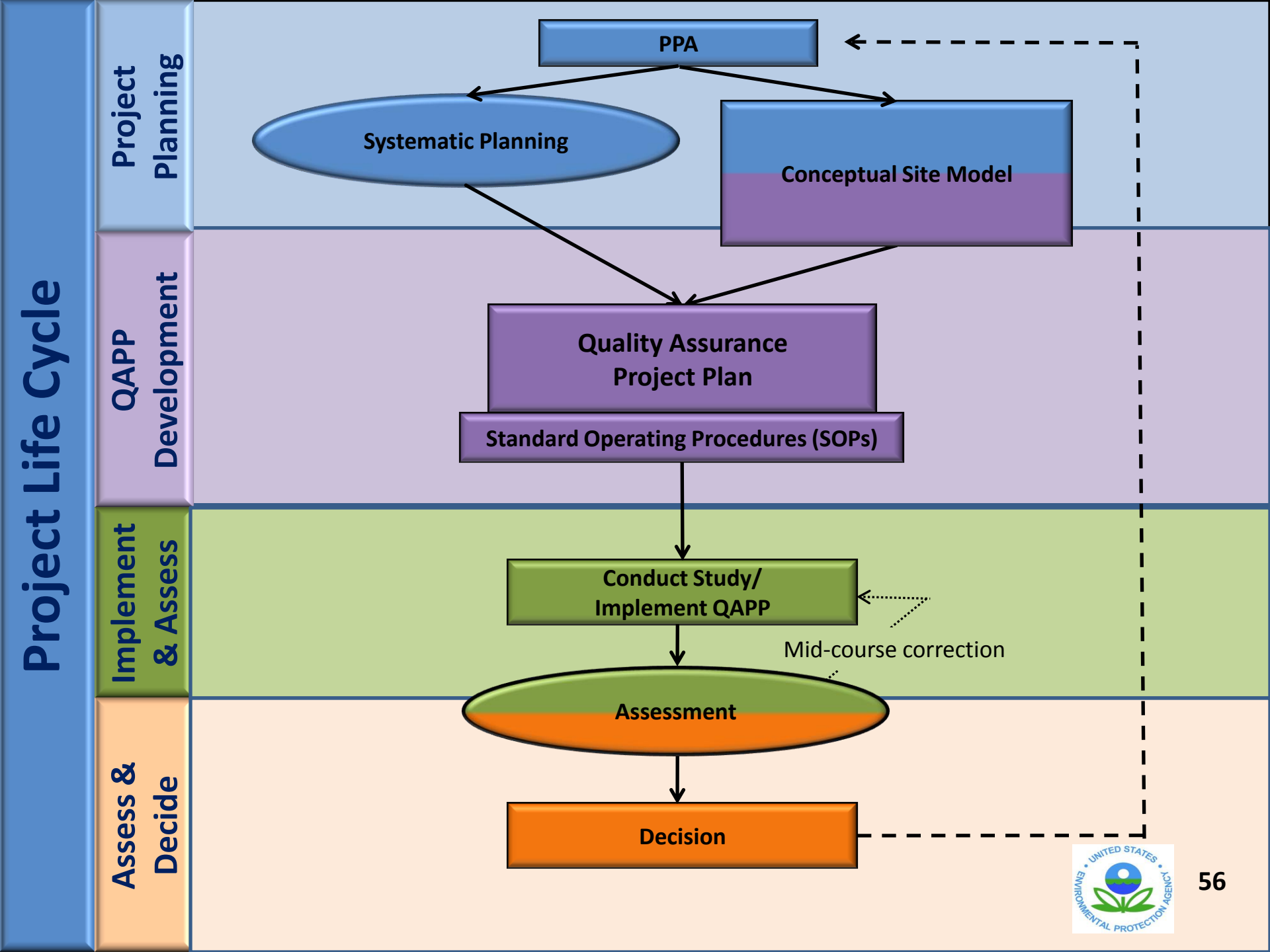
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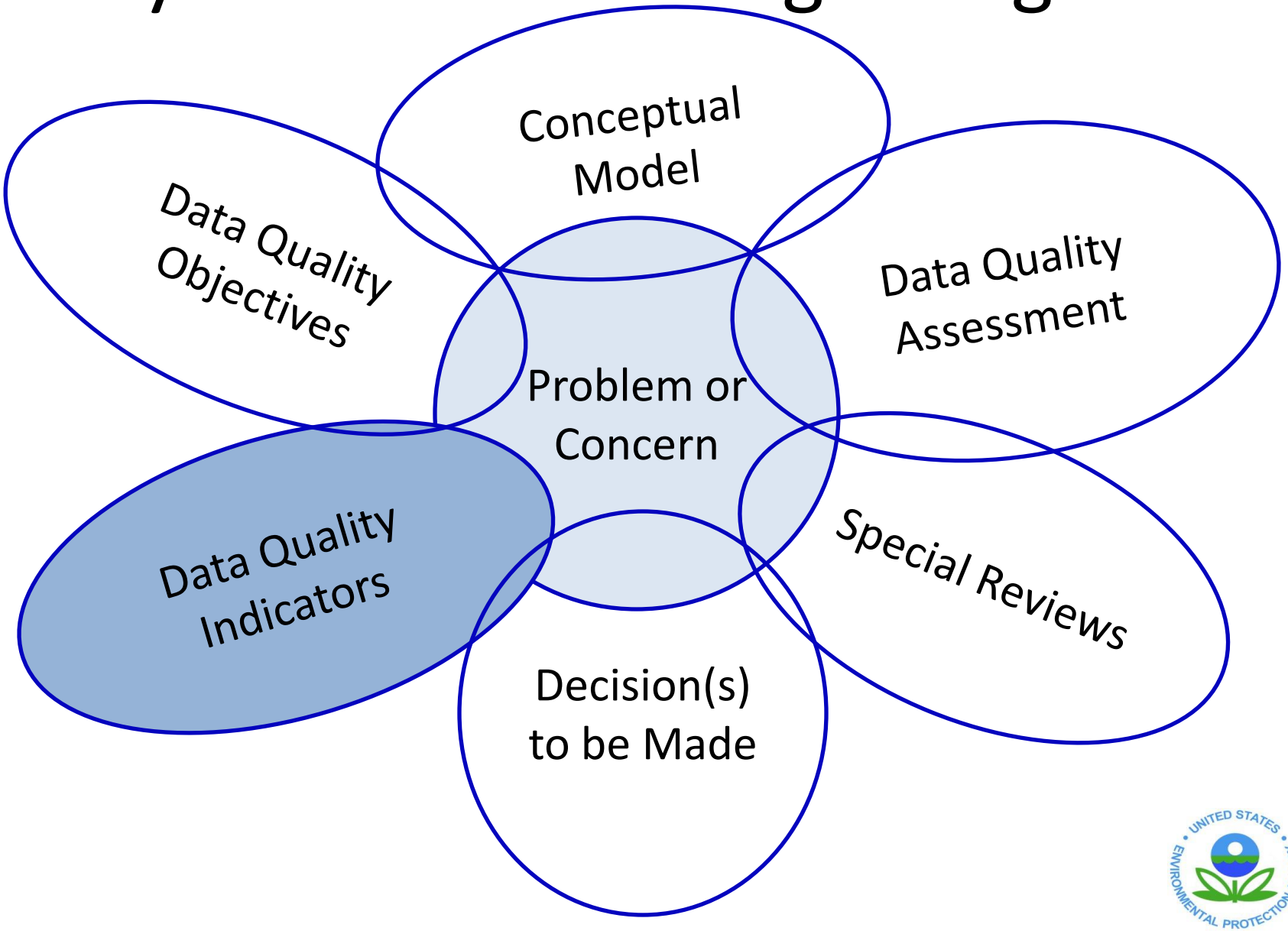
Data Quality Indicators

Jeff Pritt, EPA

Systematic Planning: Integrates



Project Management

Data Quality Indicators = PARCCS

Precision

Measured using replicates (duplicates) (field and lab)

Accuracy (bias)

Measured using blanks and matrix spikes (field and lab)

Representativeness

Does the sample design and collection represent the site conditions? (e.g., preservation, holding time, sample location)

Completeness

Defines how much data is required to meet Quality Objectives, including QA samples.

Comparability

Ensure data are reported in correct units and comparable methods. (e.g., Nutrients *as nitrogen* or *as nitrate*, data from different laboratories by different methods)

Sensitivity

Ensure the method detection limits/reporting limits are sufficient for Quality Objectives.

Data Quality Indicators Worksheet

(Measurement Performance Criteria Table - in packet)

Matrix	
Analytical Group	
Concentration Level	

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQI)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)

Data Quality Indicators Worksheet

(Measurement Performance Criteria Table - in packet)

Matrix	Ground water
Analytical Group	VOCs
Concentration Level	Low level

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQI)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Your VOC sampling procedure	524.3	Accuracy (bias)	No analytes greater than the project required reporting limit.	Trip blanks	S&A
		Accuracy (recovery)	80-120% of spiked amount	Matrix spike	S&A
		Accuracy (recovery)	80-120% of the target analyte concentration of LCS	Laboratory Control Sample (LCS)	A
		Precision	≤ 30% RPD	Matrix spike duplicate	S&A
		Precision	≤ 20% RPD (≤ 50% if concentration is ≤2 x the lab MRL)	Field duplicate	S&A
		Sensitivity	≤ lab RL	Lab blanks	A
		Comparability	Report results in ug/L, using generally accepted, published, or approved methods	Data assessment	
		Completeness	90% field samples, 100% QA samples	Data assessment	
Your well purging and sampling procedure		Representativeness	As per well sampling procedure; proper container and preservation	Data assessment	

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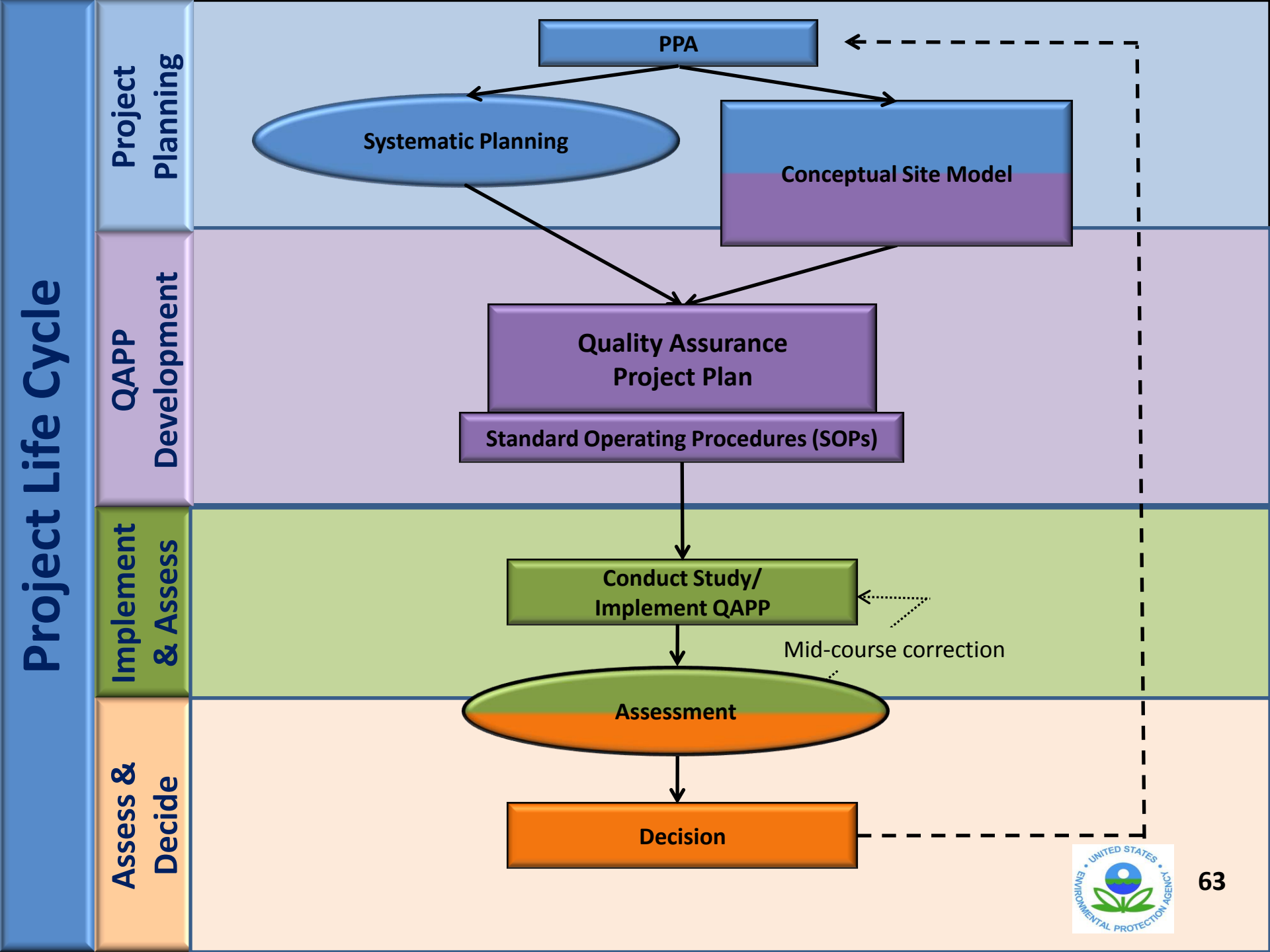
Project Assessment and Oversight

Tom Brooks, EPA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QAPP Assessment and Oversight Elements

- Assessment/Oversight activities done to see if project is conducted per the QAPP
- C1 Assessments and Response Actions
- C2 Reports to Management

Project Assessment

Types of Assessments

- Field Assessment
  - ✓Self-Assessment
  - ✓Independent Assessment
- Laboratory Assessment
  - ✓Formal Laboratory Audit
  - ✓PE Samples
  - ✓Inter-laboratory Study
  - ✓Multiple Analytical Methods
- Data Inspection

C1 Assessments and Response Actions

For Each Assessment Activity, Define:

- What is the Activity?
- Evaluation Criteria
- Frequency and Schedule
- Participants and Roles
- Corrective Actions
- Documents and Reports Generated

C2 Reports to Management

- Assessment Reports
- Results of Performance Evaluation Samples
- Final Project Report

Data Assessment for Quality Assurance Project Plans (QAPP)

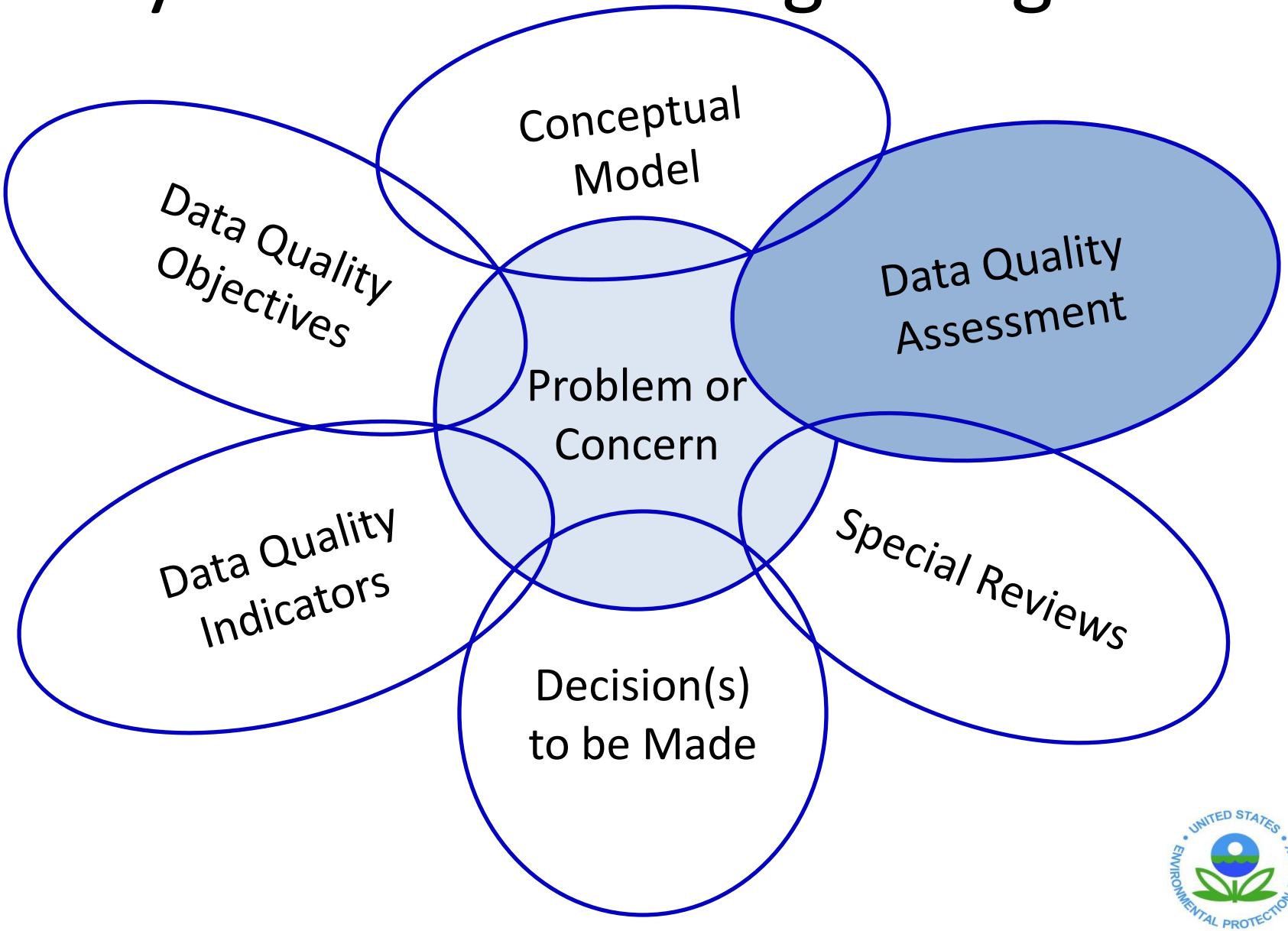
Check Please!

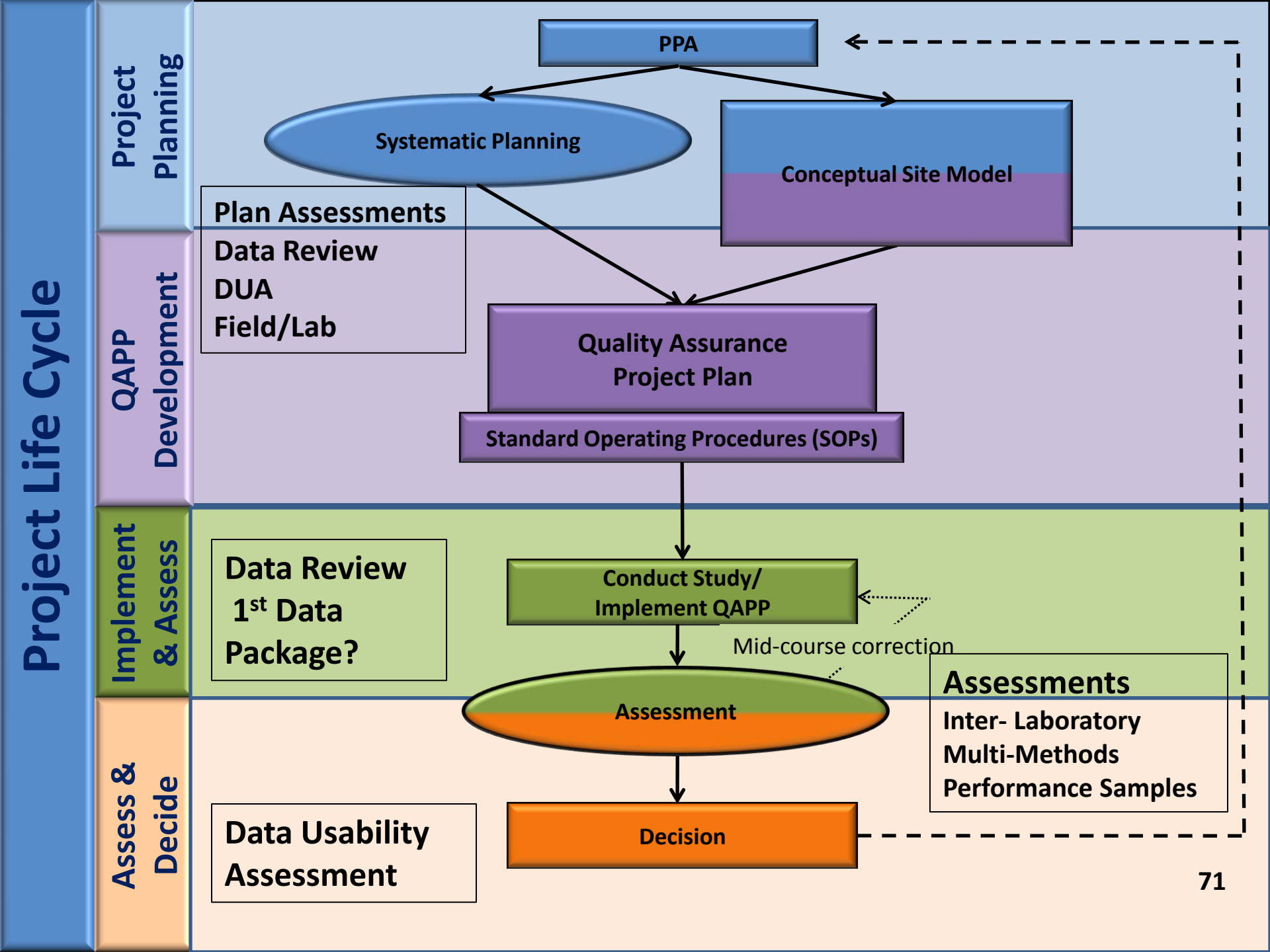
Bill Monson, EPA

Key Points: Data Assessment for QAPPs

- Think Assessment from the Beginning
- Evaluate ALL the Data – Field, Laboratory, and Acceptance Criteria As Soon As Possible (ASAP)
- Data Reviews and Data Usability Assessments (DUA) are part of all QAPP.
- Data Quality Objectives (DQO), the Data and DUA together form an Integrated Approach to Decision Making.

Systematic Planning: Integrates

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Field/Lab
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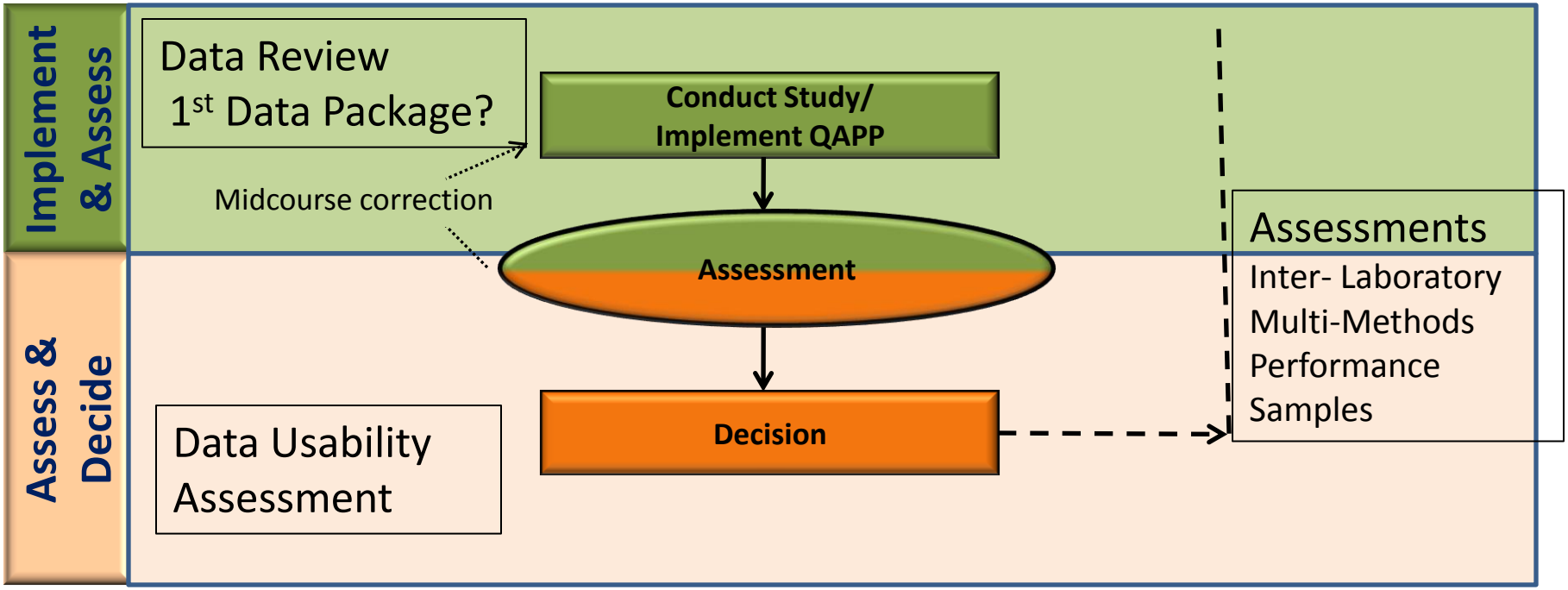
Standard Operating Procedures (SOPs)
Data Review 1st Data Package?
Conduct Study/ Implement QAPP
Mid-course correction
Assessment
Assessments
Inter- Laboratory
Multi-Methods
Performance Samples
Data Usability Assessment
Decision

Project Life Cycle and the Assessment Elements of a QAPP



Data Review

Data Usability Assessment

Other Assessments

D1 Data Review, Verification and Validation
D2 Verification and Validation Methods

D3 Reconciliation with User Requirements (Data Usability)

C1 Assessments and Responses
C2 Reports to Management

Data Review

- What do I look for in Reviewing the Data Package?
  - Chain of Custody?
  - Lab request form?
  - Is there a Case Narrative?
  - Did the Lab Supply QC Samples?
  - Are there PARCCS or DQI?

- What are the Questions in Reviewing the Data?
  - Is the quality of the data consistent across data?
  - Does the data match the Conceptual Model?
  - Does the data meet the DQO?

QAPP Element

D3: Reconciliation with User Requirements

a) Describe the procedure to evaluate the uncertainty……

b) Describe the limitations on the data …..

Data Quality Assessment Process

1. Review Data Quality Objectives and Data Collection Design
2. Conduct a Data Review
3. Identify the Decision or Estimation Method
4. Verify the Assumptions of the Method
5. Draw Conclusions

- **Data Quality Assessment: A Reviewer's Guide EPA QA/G-9R**

Characteristics of an Assessment

- Acceptance/Rejection Criteria
- Measurement or Comparison Method
- Response or Corrective Action(s)

Data Review	Data Usability Assessment	Other Assessments
Data Quality Indictors (DQI) Data Validation and Verification Data Qualifiers, Mid-Course Correction	Data Quality Objectives (DQO) Data Quality Assessment Project Decision	Acceptance Criteria Measurement Method Response Options, Mid-Course Correction

Key Points: Data Assessment for QAPPs

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Developing QA Project Plans

Summary

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QAPP Data Generation and Acquisition Elements

- **B1 Sampling Process Design (Experimental Design)**
- **B2 Sampling Methods**
- B3 Sample Handling and Custody
- **B4 Analytical Methods**
- **B5 Quality Control**
- B6 Instrument/Equipment Testing, Inspection, and Maintenance
- B7 Instrument/Equipment Calibration and Frequency
- B8 Inspection/Acceptance of Supplies and Consumables
- B9 Non-direct Measurements
- B10 Data Management

QAPP Project Assessment and Oversight Elements

- **Assessment/Oversight activities done to see if project is conducted per the QAPP**
- **C1 Assessments and Response Actions**
- **C2 Reports to Management**

QAPP Data Verification/Validation and Usability Elements

- **D1 Data Review, Verification, and Validation**
- **D2 Verification and Validation Methods**
- **D3 Reconciliation with User Requirements**
  - **Identification of data to be evaluated**
  - **Evaluation methods and criteria**
  - **Roles and responsibilities for evaluation**
  - **How limitations on data use will be reported**
  - **How results of assessments and data evaluations may be considered in decision-making**

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Additional Resources

http://www.epa.gov/region8/qa

http://www.epa.gov/quality


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Thank you