

# Collecting Trustworthy Data

## Quality Assurance

## for Environmental Studies



Credit: NOAA - NERR

Presented by  
Ann Bailey  
EcoChem, Inc.

NOAA/NOS  
October 16, 2003



# EcoChem, Inc.

## Seattle, Washington

**Founded 1983**

***“...dedicated to developing data into  
reliable environmental information”***

- ▶ Quality Assurance Plans
- ▶ Laboratory Coordination
- ▶ Data Validation
- ▶ Data Management
  - Historical
  - Current



# Quality Assurance

**A system of activities designed to  
produce data of known and  
acceptable quality**

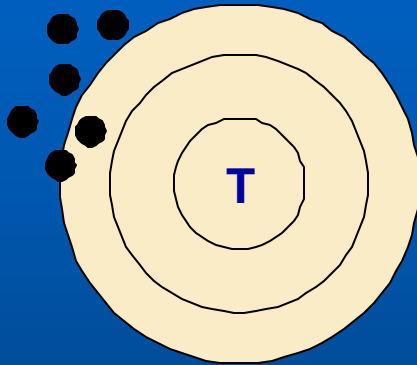
John Keenan Taylor  
NIST

# Why do we need QA?

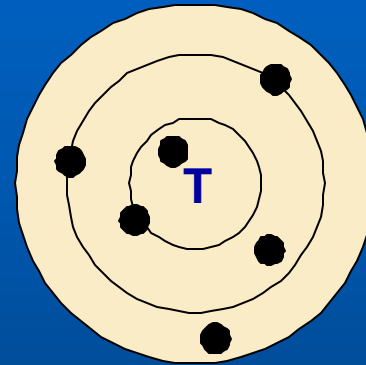


Photo Credit: Gordon Richardson

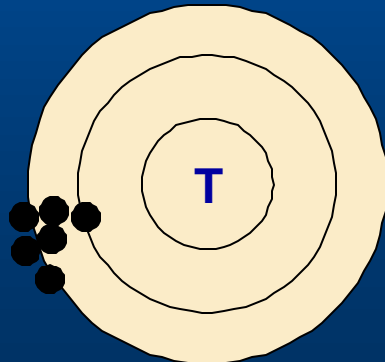
# Why do we need QA?



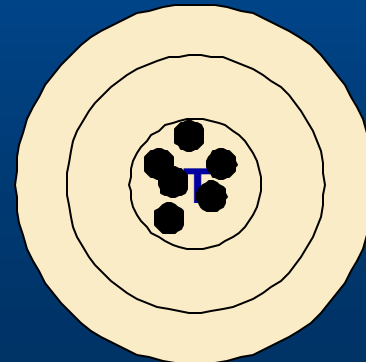
High bias + low precision =  
low accuracy



Low bias + low precision =  
low accuracy



High bias + high precision =  
low accuracy



Low bias + high precision =  
high accuracy

# How to do it...

- Plan
- Implement
- Assess

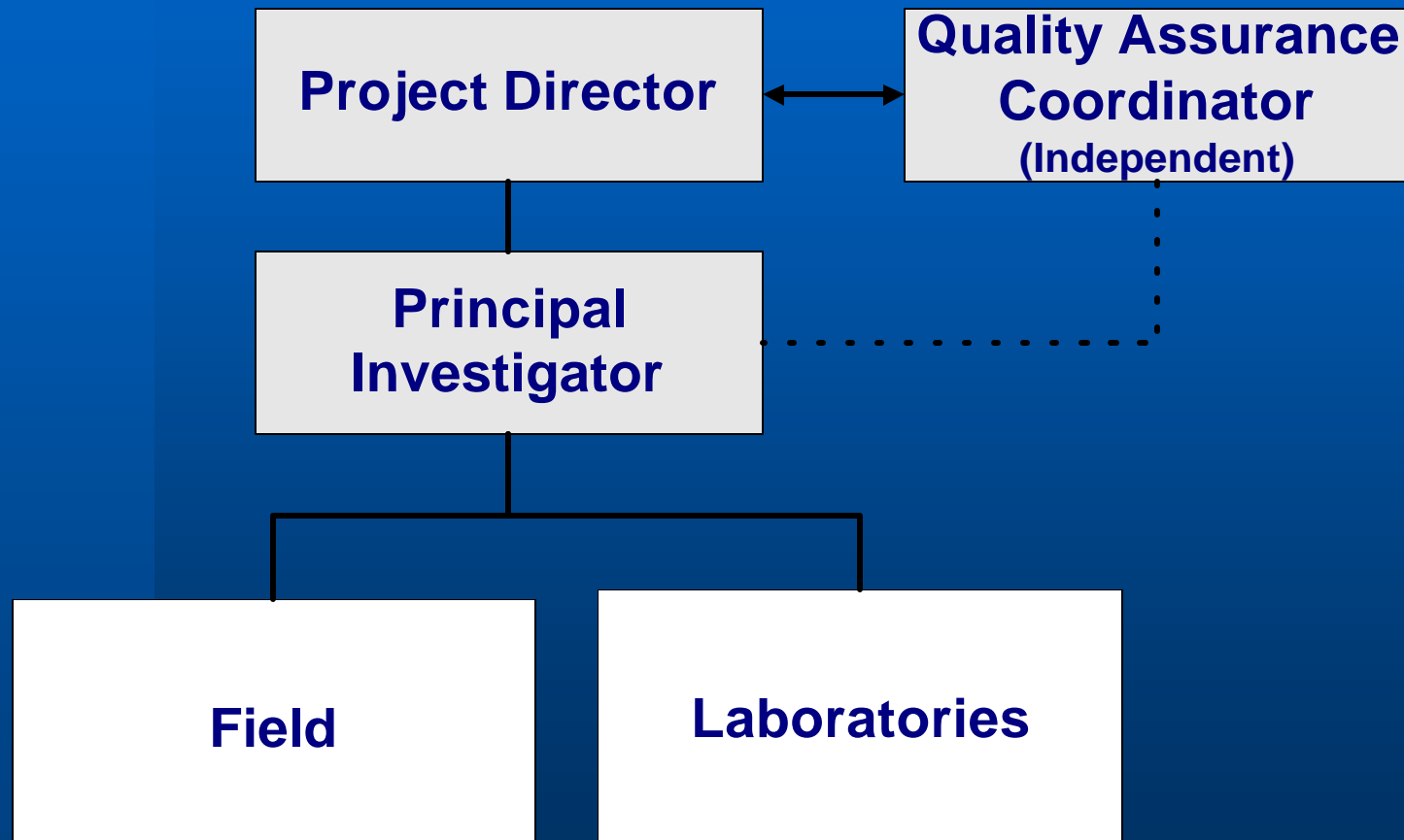


Credit: NOAA

Quality is never an accident, it is  
always the result of intelligent effort.

John Ruskin (1819-1900)  
British philosopher, artist, author, critic

# Quality Assurance Organization



# Plan

## Study Plan

- Define goals and objectives
- Develop Data Quality Objectives (DQOs)
- Develop schedules and reporting requirements
- Build consensus among project participants



# Plan

- **Sampling and Analysis Plan**
  - ▶ **Field and Laboratory SOPs**
  - ▶ **QA/QC Plan--Measurement Quality Objectives**
  - ▶ **Health and Safety Plan**

# Implement

- **Sample Collection**

- ▶ **SOPs**

- ▶ **Documentation**

- Data sheets*

- Photos*

- Chain of custody*

- Preservation*

“The horror of that moment,” the King went on, “I shall never, never forget!”

“You will, though,” the Queen said, “if you don’t make a memorandum of it.”

*Through the Looking Glass*

1872

# Common Pitfalls

- **Sample Generation**

- ▶ **Lack of Training**

- ▶ **No DQOs**

- ▶ **Documentation**

- **Mis-labeled samples**
- **Erroneous numbers**
- **Illegible**



# Implement

- **Sample Analysis**
  - ▶ **SOPs**
  - ▶ **Control Materials**
    - **SRMs**
    - **Spikes**
    - **Blanks**
  - ▶ **Data Reporting**



Credit: U. S. Fish and Wildlife Service

# Common Pitfalls

- **Data Generation**

- ▶ **Lack of SOPs**
- ▶ **Inadequate Instrument Calibration**
- ▶ **Lack of Control Materials**
- ▶ **Inadequate Quality Objectives**
- ▶ **Raw Data Poorly Organized**



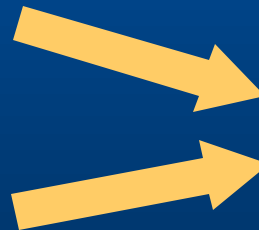
# Assess

- **Peer Review**
  - ▶ Study Plans
  - ▶ Final Reports
- **Auditing**
  - ▶ Field/Lab
  - ▶ Data Quality Assessment

# Archive

- **Everything necessary for the reconstruction and evaluation of the report for that study**

**Samples** - physical evidence of all types



**Inventory Database**  
- who, what, where

**Raw Data** - records, documentation, etc.

# Three Critical Elements to Demonstrate Quality

- 1) Utility** - *Usefulness of the information to its intended users, including the public*
- 2) Integrity** - *Protection and security of information from unauthorized access or revision to prevent corruption or falsification*
- 3) Objectivity** - *Presentation of accurate, reliable, unbiased information in an accurate, clear, complete and unbiased manner within the proper context*



# Three Critical Elements to Demonstrate Quality

## 1) Utility

*Usefulness of the information to its intended users, including the public*

### ***Accomplished by:***

- ▶ Appropriate study design
- ▶ Sampling and analysis procedures

### ***Products:***

- ▶ Work Plans
- ▶ Sampling Plans
- ▶ Quality Assurance Plans

# Three Critical Elements to Demonstrate Quality

## 2) Integrity

*Protection and security of information from unauthorized access or revision to prevent corruption or falsification*

### ***Accomplished by:***

- ▶ Chain of custody protocols
- ▶ Appropriate data documentation
- ▶ Compilation procedures

### ***Products:***

- ▶ Chain of custody records
- ▶ Data verification records

# Three Critical Elements to Demonstrate Quality

## 3) Objectivity

*Presentation of accurate, reliable, unbiased information in an accurate, clear, complete and unbiased manner within the proper context*

### **Accomplished by:**

- ▶ Documented sampling & analysis procedures
- ▶ Data quality control checks
- ▶ Presentation of complete data set

### **Products:**

- ▶ Standard operating procedures
- ▶ Validation reports
- ▶ Data quality assessment reports

Adapted from: *Unlocking the Mystery of the Data Quality Act: What it Means for NOAA Research* - Jamie Krauk, Office of Scientific Support, August 6, 2002