

Approaches to Environmental Data Quality: A Historical Perspective

1

ASQ Section 0511 Meeting
July 11, 2018
Ken Rapuano
Senior Chemist
HydroGeoLogic, Inc.

What is data quality?

**Quality data is:
acceptable for decision-making or
estimation of population
parameters.**

The Road to Environmental Data Quality

Awareness

Action

Compliance

Liability

Defensibility

Anticipation

Part 1: The Creation of the EPA and pollution prevention programs

Awareness: Impacts on the environment were impossible to ignore

Not seaweed



Not a shadow



(Credit: USGS)

1969: The Santa Barbara Oil Spill



(Credit: Cleveland State University Library)

Cuyahoga River fire



(Credit: The Ad Council)

The Tear Heard 'Round the World



(Credit: The New York Times)



←
Not oil

(Credit: NASA)

“Earthrise” – Apollo 8, Christmas Eve, 1968

Legislative Action: The 1969 National Environmental Policy Act

10



(Credit: Richard M. Nixon Presidential Library)

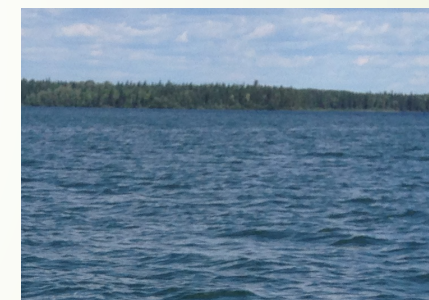
Executive Action: The EPA is formed December 2, 1970.
William Ruckelshaus is the first EPA Administrator

Legislative Action: Pollution Prevention and **compliance**

1970 – Clean Air Act (CAA)



1972 – Clean Water Act (CWA)



1974 – Safe Drinking Water Act (SDWA)

Each of these landmark laws required sampling and analysis to demonstrate **compliance**.

Legislative Action: Pollution Prevention and **compliance**

1976 – Resource Conservation and Recovery Act (RCRA)

Governs the management of solid and hazardous waste

- Requires managing the *life cycle* of hazardous chemicals “**from cradle-to-grave**”
- Focused on *ongoing operations* at **active facilities**

1980: The EPA (OSWER) publishes SW-846 to support RCRA
“Test Methods for Evaluating Solid Waste, Physical/Chemical Methods”.

SW-846 has become one of the most important analytical compendia in the environmental industry.

- It provides a **comprehensive and adaptable** suite of performance based analytical methods
- Analytical results obtained from SW-486 analysis yield **consistent technical quality**.

What defines “quality data” for Pollution Prevention Programs?

It is focused on **technical** quality of data

- Using **approved analytical methods** (e.g. SW-846)
 - *Some analytical methods are specifically required by regulation*
- Using **accredited laboratories**

Common Characteristics

- Data generated by the regulated entities
- *Compliance, including sampling and analysis, is a cost of doing business*
- Data generators have a *vested interest* in supporting the quality of the data.

Part 2: CERCLA and its Implications

Pollution prevention programs were an overall success

- Cleaner environment
- Safer drinking water
- Control of hazardous waste

However ...

Identification and cleanup of contaminated sites still needed to be addressed.

Love Canal (near Buffalo, NY)

18



(Credit: The Buffalo News)

The Valley of the Drums (Bullitt County, KY)

19



(Credit: EPA)

Times Beach (near St. Louis, MO)

20



(Credit: Yahoo)

The Comprehensive Environmental Response, Compensation, and *Liability* Act (“Superfund”) becomes law in December 1980.

CERCLA:

- established prohibitions and requirements concerning closed and abandoned hazardous waste sites;
- provided for liability of persons responsible for releases of hazardous waste at these sites; and
- established a trust fund to provide for cleanup when no responsible party could be identified.

(www.EPA.gov)

Data Uses under CERCLA

- **Identify potential sites**
- **Prioritize sites**
- **Characterize sites**
- **Remediate sites**

Quality data are required!

- **Reduces decision errors**
- **Ensures cost-effective allocation of resources**
- **Maximizes acceptance of results**

CERCLA did not replace the pollution prevention programs initiated in the 1970s:

- Applies to Potentially Responsible Parties (PRPs)
- Compliance is not a cost of doing business
 - Creates a *liability* for past actions.
 - A previous occupant's actions can make the current land owner a PRP

The data quality paradigm for pollution prevention programs could not work for CERCLA.

Regulated Entity's Relationship to the Data

Non-CERCLA

- Generates the data
- Participation in process
- Advocate for quality of data

CERCLA

- Data generated by others
- Liability for outcomes
- Contests the quality of data

Consequently

- PRPs have no “ownership” of process.
- EPA responsible for data generation.

Data Quality Priorities

Non-CERCLA

- Technical quality top priority
- Legal defensibility important but secondary

CERCLA

- Legal defensibility essential
- Technical quality important, **BUT ...**
- **Data cannot stand on technical quality alone**

Consequently

- EPA developed programmatic requirements for each step of the environmental investigation process for CERCLA.
 - Data obtained in compliance with these requirements minimizes, but cannot eliminate, exposure to legal challenge.

Analytical Method Characteristics

26

Non-CERCLA

- Descriptive
- Performance-based

CERCLA

- Prescriptive
- Conformance a critical component of legal defensibility

Consequently

- The EPA established the Contract Laboratory Program (CLP).
 - CLP Scope of Work includes
 - contractual requirements
 - programmatic requirements
 - technical requirements

Data Use

Non-CERCLA

- Address specific, clearly defined regulatory goals.
- If litigation, usually based on data interpretation.

CERCLA

- Project-specific objectives
- Data-driven decisions potentially litigated for any reason at any stage of the process

Consequently

- CERCLA sampling must be designed to meet clearly defined data quality objectives (DQOs).
- CERCLA analytical data must be validated to ensure compliance with QC requirements for sampling and analysis.

Data Quality Objectives (DQOs)

General EPA requirements prescribe the “How?” for individual operations (sampling, shipment, analysis, &c.).

Project-specific DQOs address:

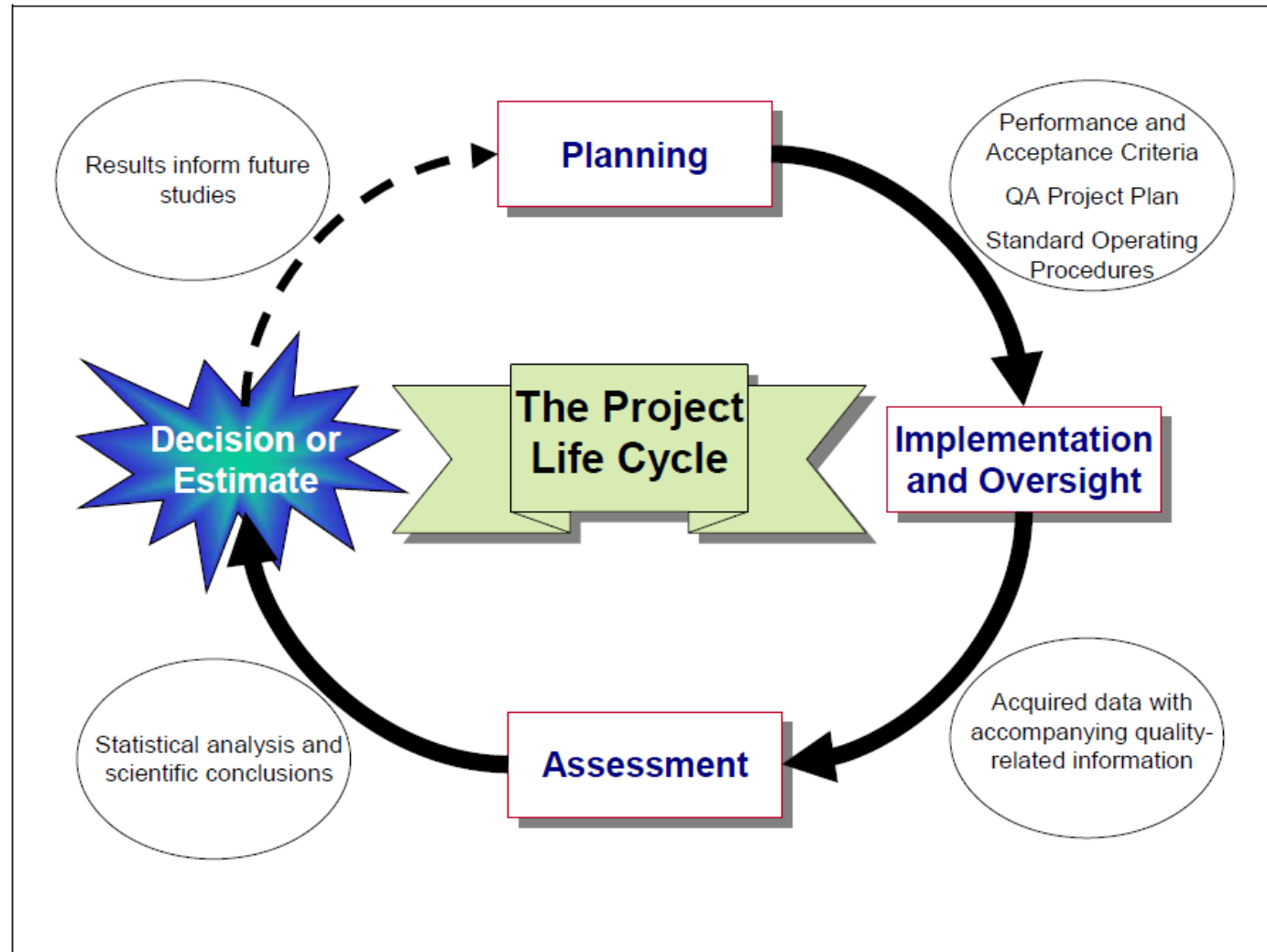
- why is the data needed?
- who will obtain it?
- where and when will it be obtained?
- how will it be obtained and evaluated?
- what will be done with it?

DQOs: The 7 Steps

1. State the Problem.
2. Identify the Goals 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 Detailed Plan for Obtaining Data.

The CERCLA Project Life Cycle

30



(EPA, 2006)

CERCLA Status

- 399 sites deleted, with 66 more partial deletions
- 1200 completed construction projects
- 1346 sites remain, with 52 more proposed

(www.EPA.gov)

PDCA and DQO approach are the “industry standard” outside the CERCLA umbrella.

Part 3 – Beyond CERCLA

Federal Impact

Other Federal entities developed quality programs for environmental sampling and analysis:

- The former Air Force Center for Environmental Excellence
- U.S. Army Corps of Engineers
- U.S. Navy
- DOE

Each agency/service branch established laboratory accreditation criteria and procedures independent of each other.

Proliferation of Quality programs

Late 1990s multiple state, EPA, and Federal quality programs were in force.

Laboratories suffered “death by audit” with overlapping accreditation cycles.

Contractors were handcuffed in laboratory selection.

1995: The National Environmental Laboratory Accreditation Conference (NELAC) is established in response



Goals:

- Develop uniform accreditation standards
- Adopt standards for use in accreditation programs
- Develop system for recognition of state agencies (Accrediting Authorities)
- Voluntary implementation of the accreditation program (NELAP) by those states who chose to participate

NELAC merged with the Institute for National Environmental Laboratory Accreditation (INELA) in 2006 to form The NELAC Institute (TNI)

(TNI, 2007)

TNI Participation by States



- States can establish laboratory accrediting bodies.
- Accreditation by one state can be accepted by multiple other states by reciprocity (state fees still apply).
- Reduces, but does not eliminate overlapping audit and accreditation requirements.

DoD Programs consolidate



2000: DoD (QSM) establishes programmatic QA requirements
environmental laboratories contracted to DoD:

- Current Version 5.1.1, January 2018
- Incorporates TNI standards and ISO/IEC 17025:2005(E), *General requirements for the competence of testing and calibration laboratories*
- Includes QC and corrective action for specific analytical methodologies
- Replaced service-specific quality programs
- Consolidated with DOE QA program as of version 5 (July 2013)

DoD Environmental Laboratory Accreditation Program (ELAP)

- Established October 2009
- Required for all definitive data submitted to the DoD Installation Restoration Program (IRP)
- Administered by third party accrediting authorities under contract to DoD.
- Replaces service-specific accreditation requirements

Where We Are Today



The environmental field has matured:

- Industry standards have evolved
- Performance-based analytical procedures have wider acceptance, both technically and legally
- Expectations of the regulatory and regulated communities more aligned
- State programs supplement EPA regulatory framework
- DQO-based data validation supplements NFG for non-CLP projects
- Increased cross-agency collaboration

What the Future Holds

40

- DoD QSM-specific data validation guidelines
- Emerging contaminants require new sample collection and analytical methods
- Incremental sampling methodology and statistically based sampling increasing in use
- Chemicals outside the “classic” model of site pollution
 - Pharmaceuticals in drinking and surface water
 - Climate change
 - Ozone depletion
 - Endocrine disruptors
 - Agricultural and urban runoff



Questions?

Contact information:

Ken Rapuano
Senior Chemist
HydroGeoLogic, Inc.
11107 Sunset Hills Rd, Suite 400
Reston, Virginia 20170
(703) 736-4546
krapuano@hgl.com

References:

EPA, 2006. EPA QA/G-4: Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA/240/B-06/001. February.

TNI, 2007. Presentation to the Association of Public Health Laboratories (AHPL) 2007 Annual Meeting:
https://www.aphl.org/conferences/proceedings/Documents/2007/Annual-Meeting/NELAC_Institute.pdf