ENVIRONMENTAL DATA QUALITY AND THE SEARCH FOR REPRESENTATIVENESS

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DoD Environmental Monitoring and Data Quality Workshop

EPA has Mandates for "Sound Science"

Using
SOUND SCIENCE
in the cleanup of contaminated sites means that the
the scale of data generation and interpretation
must closely "match"
the scale of project decisions being based on that data.

Sound science also means managing uncertainty
since an exact match usually is not feasible.

The current environmental data quality model is inadequate to ensure that this matching occurs.

Take-Home Message

- **Triad Approach** = Integrates **systematic planning**, **dynamic work plans**, and **real-time analysis** as applied to wastes and contaminated sites to ⇓ time & costs and ⇑ decision certainty
- Theme for the Triad Approach = Explicitly identify and manage the largest sources of decision error, especially the sampling representativeness of data
- The Triad Approach seeks to institutionalize uncertainty management through holistic integration of innovative data generation and interpretation tools

What has Changed since the 1980s?

- **Research and better technologies have produced better understanding of contaminated sites**
  - Realize that contaminant behavior in the environment is much more complex than expected
  - Realize that environmental matrices are often EXTREMELY heterogeneous in space and behavior. The better detection tools get, the more complexity and heterogeneity is found.
  - Oversimplified models give wrong answers
    - » Costly consequences!
  - Better models can give better predictions—but are more complicated to use

The Mechanics of the Triad Approach

Systematic Project Planning

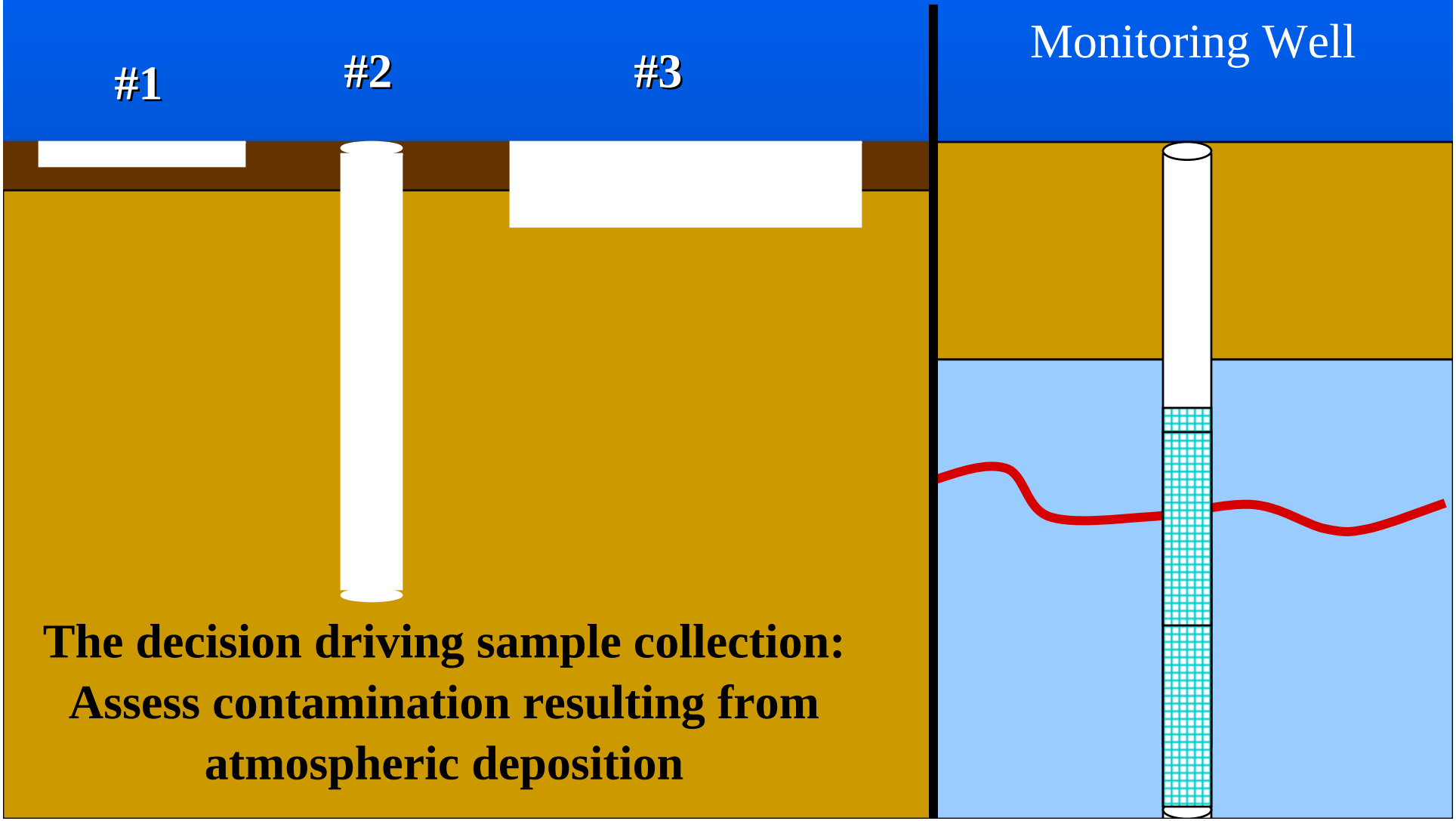
Dynamic Work Plan Strategy

Real-time Measurement Technologies

Synthesizes practitioner experience, successes, and lessons-learned into an institutional framework

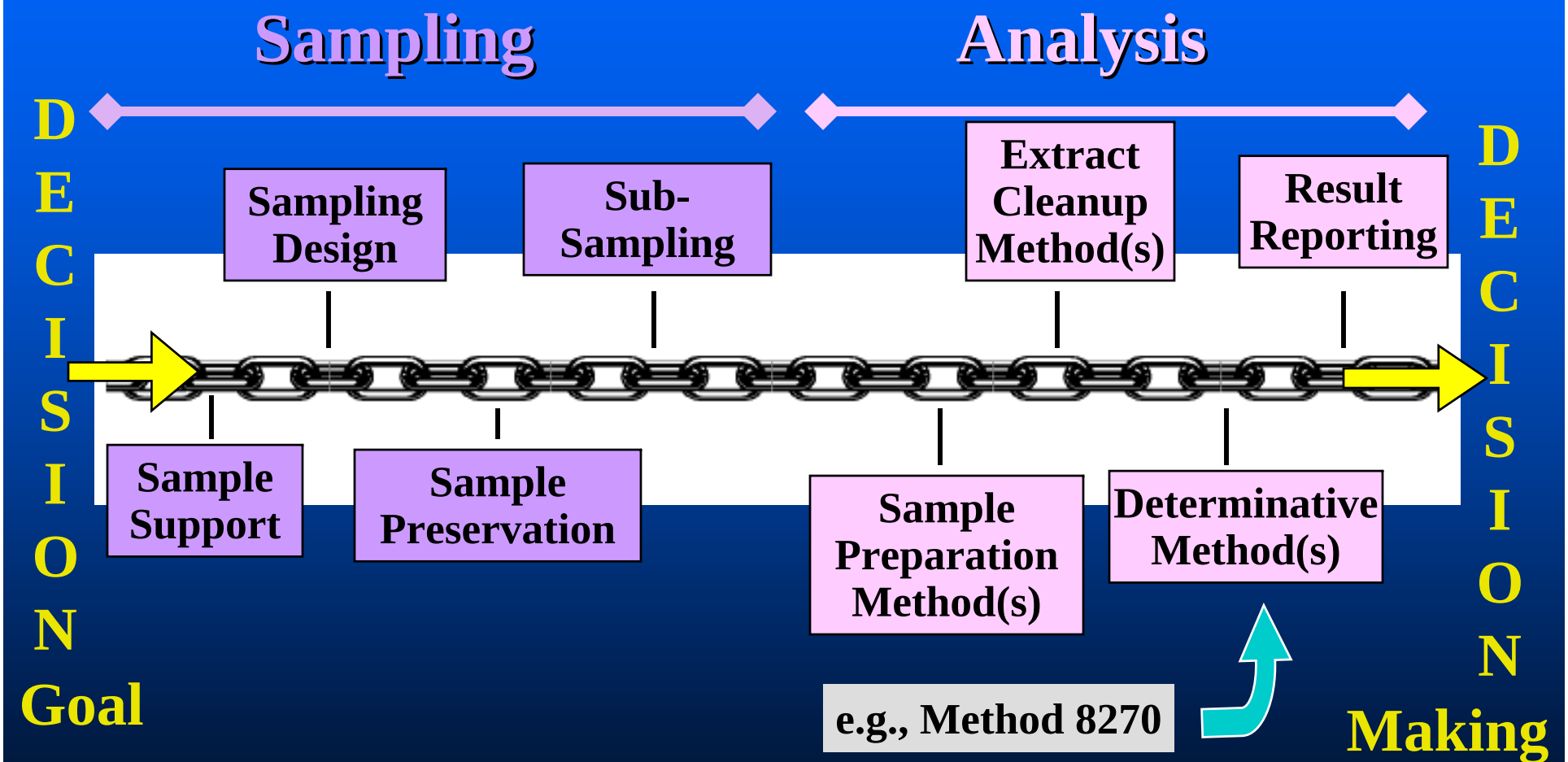
Sample Support: Critical to Representativeness

Sample Volume & Orientation: 1 aspect of sample support



The decision driving sample collection: Assess contamination resulting from atmospheric deposition

The Data Quality "Chain"



All links in the Data Quality chain must be intact for Decision Quality to be supported !

Reality: Data used for Project Decision Making is Generated on Samples

Perfect Analytical Chemistry + **Non-Representative Sample**

"BAD" DATA

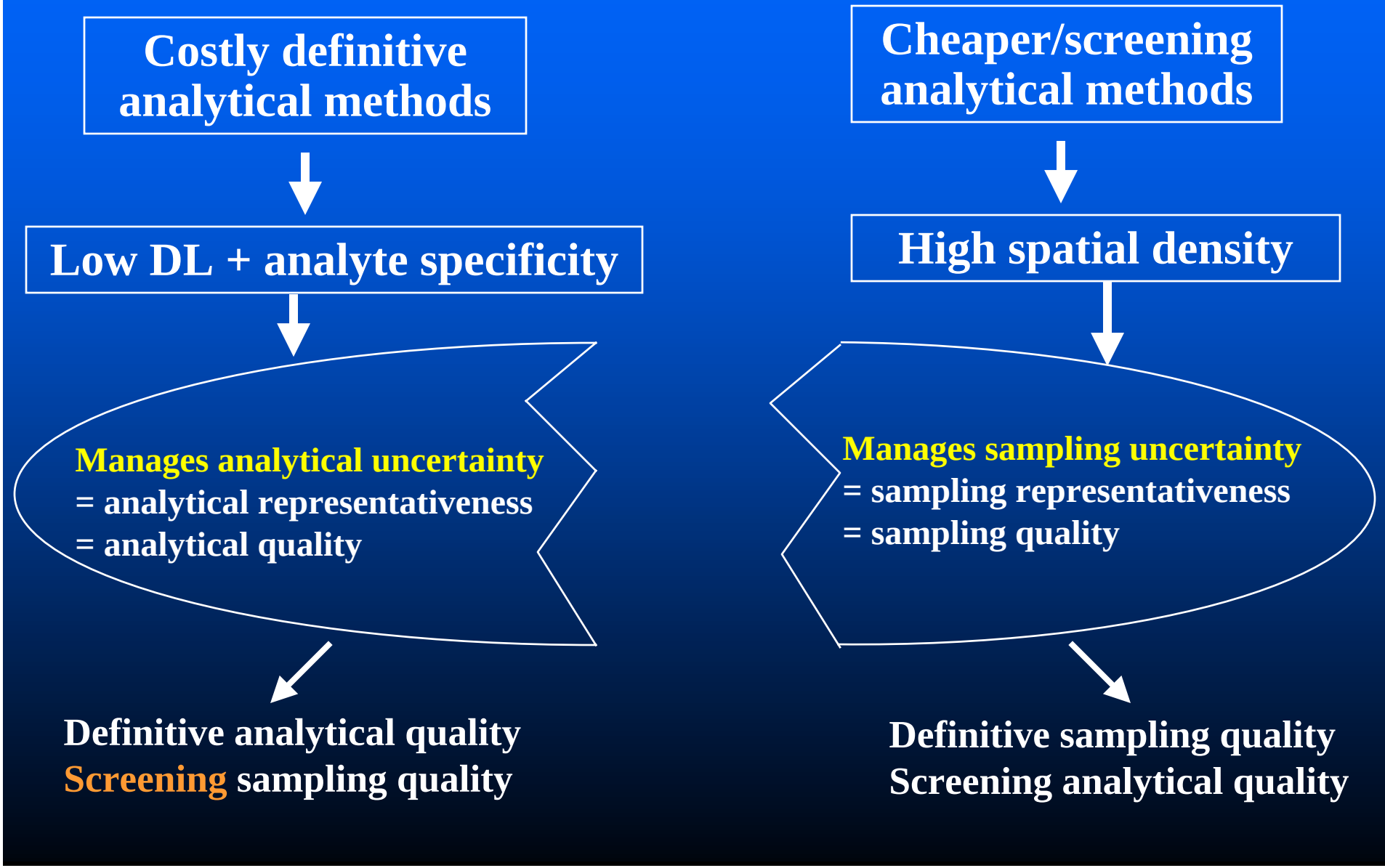
Distinguish:
Analytical Quality from Data Quality

What is "Data Quality"?

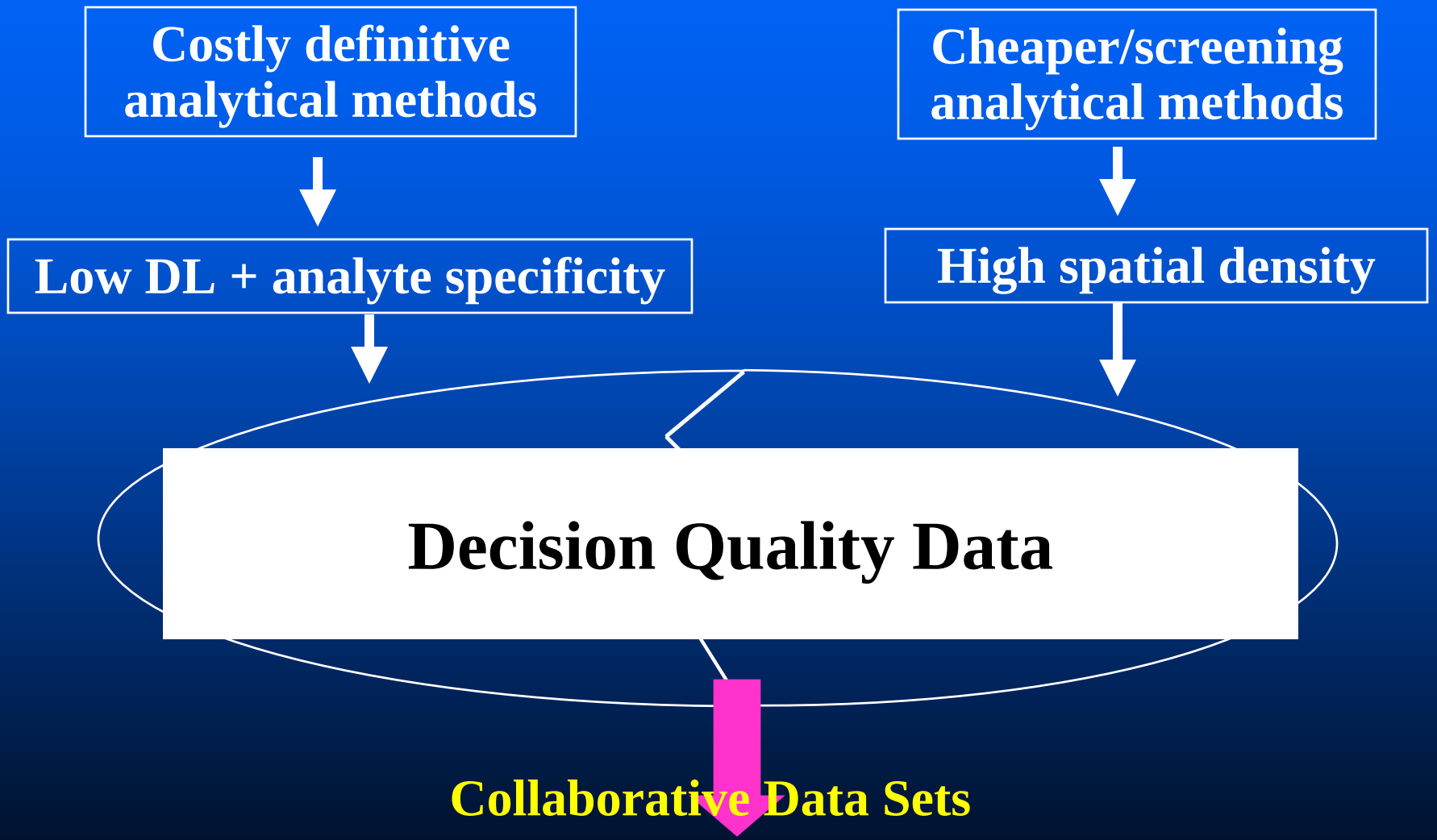
Data Quality = The ability of data to provide information that meets user needs

- Users need to make correct decisions
- Data quality is a function of data's…
  - ability to represent the "true state" in the context of the decision to be made
    - » The decision defines the scale for the "true state"
  - information content (including its uncertainty)

Will the Real "Screening Data" Please Stand Up?

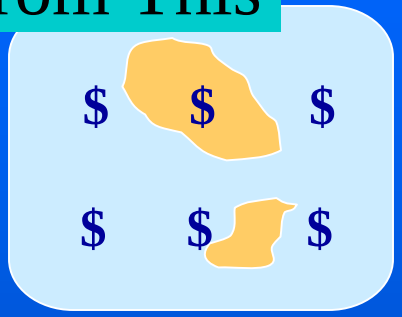


Marrying Analytical Methods to Make Sound Decisions Involving Heterogeneous Matrices



Managing Sample Representativeness

From This

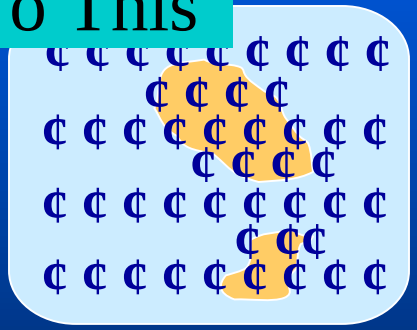


Fixed Lab Analytical Uncertainty

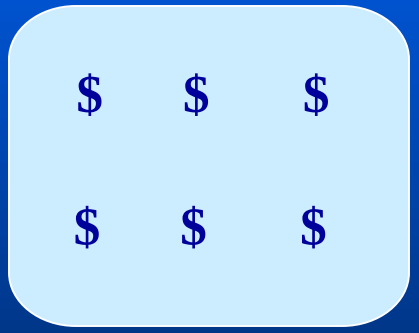
Ex 1

Sampling Uncertainty

To This



Remedy: remove hot spots



Fixed Lab Data

Ex 3

Decreased Sampling Variability after Removal of Hotspots

Field Analytical Data

Ex 2

Sampling Uncertainty Controlled through Increased Sampling Density

Ex 1

Ex 2

Ex 3

Meeting Challenges to Support the Triad

- Staff Appropriate Technical Disciplines
  - Planning
  - Fieldwork
- Design Field QA Protocols that Evaluate Data's ability to Support Decision-Making
  - Evaluate Heterogeneiety Issues / Impact
  - Performance Criteria / Confirmatory Analysis Needs Based on Data's USE!!

Meeting Challenges to Support the Triad

- Establish Plans Which Clarify Decision Logic / Contingencies
- Adopt Virtual Tools to Communicate New Information, Maturing CSM, and Progress to all Stakeholders
- Do not limit analytical design to SW846
  - Bring lab to the field or field analytics to the lab
- Adopt Contracting Mechanisms Conducive to an Enhanced Technical Project Planning

EPA/USACE Efforts to Provide Support

- **Public outreach: published articles**
  - http://cluin.org/triad/
- **Field Analytical Technologies Encyclopedia (FATE)**
- **Superfund Dynamic Field Activities guidance**
- **"PM's Handbook of Technical Best Practices to Implement the Triad Approach" (in development)**
  - Internet-based hyper-linked mapping of existing guidance and technical documents to a generalized project life cycle
- **USACE ITA Triad Technical Support Network**
  - Support with systematic planning

The Triad approach uses the concept of managing decision uncertainty as a compass charting a clear course through the complexities of site cleanup science and policy.