The Triad Approach as a Catalyst for 2nd-Generation Practices

(Talk Version)

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The purpose of the Triad approach is to bridge the disconnect between

"what is routinely done"
(based on 1980's knowledge & technology)

&

"what is now possible"
(synthesized from the experiences of successful practitioners)

2nd-Generation Practices

Does Triad introduce any brand new ideas that no one has ever thought of before?

No

Triad Builds on Prior Efforts

- Efforts to promote data quality: EPA's DQO Process (since 1987)
- EPA efforts to streamline projects:
  - Superfund Accelerated Cleanup Model (1992 & 1994)
  - RCRA Reforms (1996)
  - Expedited Site Assessment for UST sites (1997)
- Efforts to promote dynamic work plans
  - DOE's Expedited Site Characterization (ESC) (1980's)
  - ITRC Accelerated Site Characterization (ASC) team (1997)
  - ASTM ESC guidance (1998)
  - ASTM ASC guidance for UST/petroleum sites (1998)
  - Argonne National Lab ASAP (1990's)
  - Tufts University & Region 1 (1990's)
  - EPA's Dynamic Field Activities guidance (2003)

Does Triad represent a way to manage characterization & cleanup projects that is radically different from the current routine?

Yes

Some Triad Differences

- Explicit mgt of decision uncertainty
- CSM captures heterogeneity & physical reality; distinguishes decision-driven populations
- Analytical quality ≠ Data quality
- "Data representativeness" dependent on CSM & decision
  - "Sample support" and "collaborative data sets" are critical concepts
- "Touchdown" planned before field work "takes off"
  - Planning more intensive, more far-reaching, face-to-face
  - Builds "social capital"

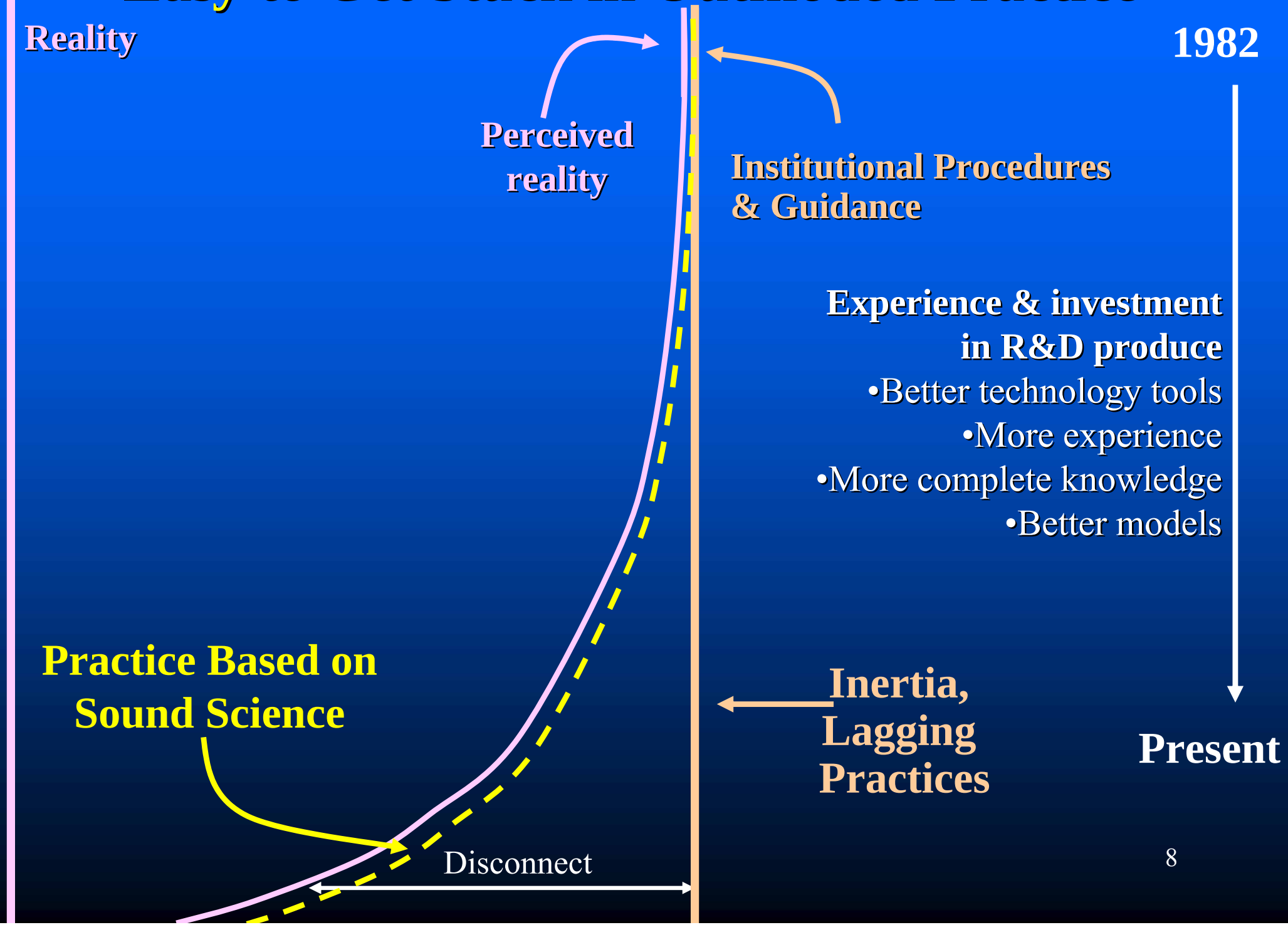
Science Has Advanced Since the 1980s

- **Good News! More & better cleanup technologies**
  - **Bad News:** success requires accurate site characterization
- **Good News! Better understanding of contaminated sites**
  - **Bad News:** cleanup science IS harder than rocket science!

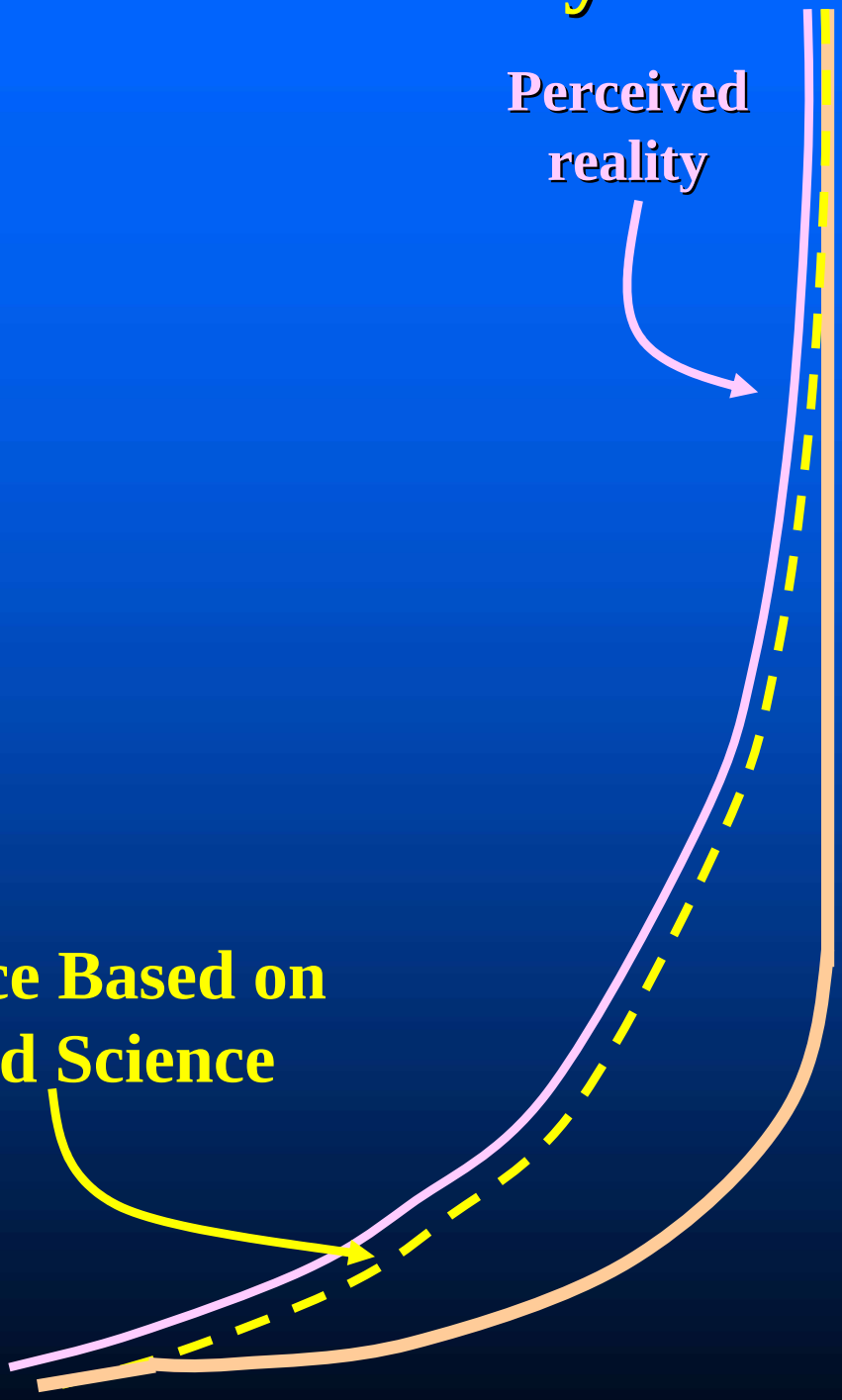
Heterogeneity Rules! Overly simple models give wrong answers and failed projects.

- **Good News! More & better investigation tools**
  - Can deal with heterogeneity to build accurate CSMs
  - **Bad News:** stuck in 1980's mentality using simple models

Easy to Get Stuck in Outmoded Practice



Triad as a Catalyst to Modernize Practices



Triad initiative attempts realignment by controlled, gradual transition

Triad Synthesized from Practitioner Success

- What work strategies succeeded at the ground level?
- Triad approach formulated from the bottom-up
  - Practitioner "tried-and-true": lessons-learned blended into cohesive framework
  - Grounded in scientific excellence
  - Only works if includes all aspects of project mgt
  - "Creates space" to address non-science issues

Successful Strategies Condense into a **Central Theme** ("what") + **3 Elements** ("how") of the Triad Approach

Systematic Project Planning

Dynamic Work Strategies

Real-time Measurement Technologies

Triad projects are demonstrably "better, faster, and cheaper" than routine…

But NO ONE is claiming they are easier!

Uncertainty Mgt at Center of Triad Projects

- Need clearly written project decision goals
  - Why? Can't manage decision uncertainty if don't know what the decisions are!
- Need a CSM
  - Why? The CSM predicts…
    - » which uncertainties matter
    - » how much sampling & analytical uncertainty to expect in data
    - » how to control variables to get representative data
- Must use a skilled multidisciplinary team
  - Why? Need people who…
    - » have the skills & knowledge to identify technical & non-technical uncertainties
    - » know how to manage those uncertainties

Triad Expects Contaminated Sites to be Heterogeneous

Triad copes with heterogeneity cost-effective by using:

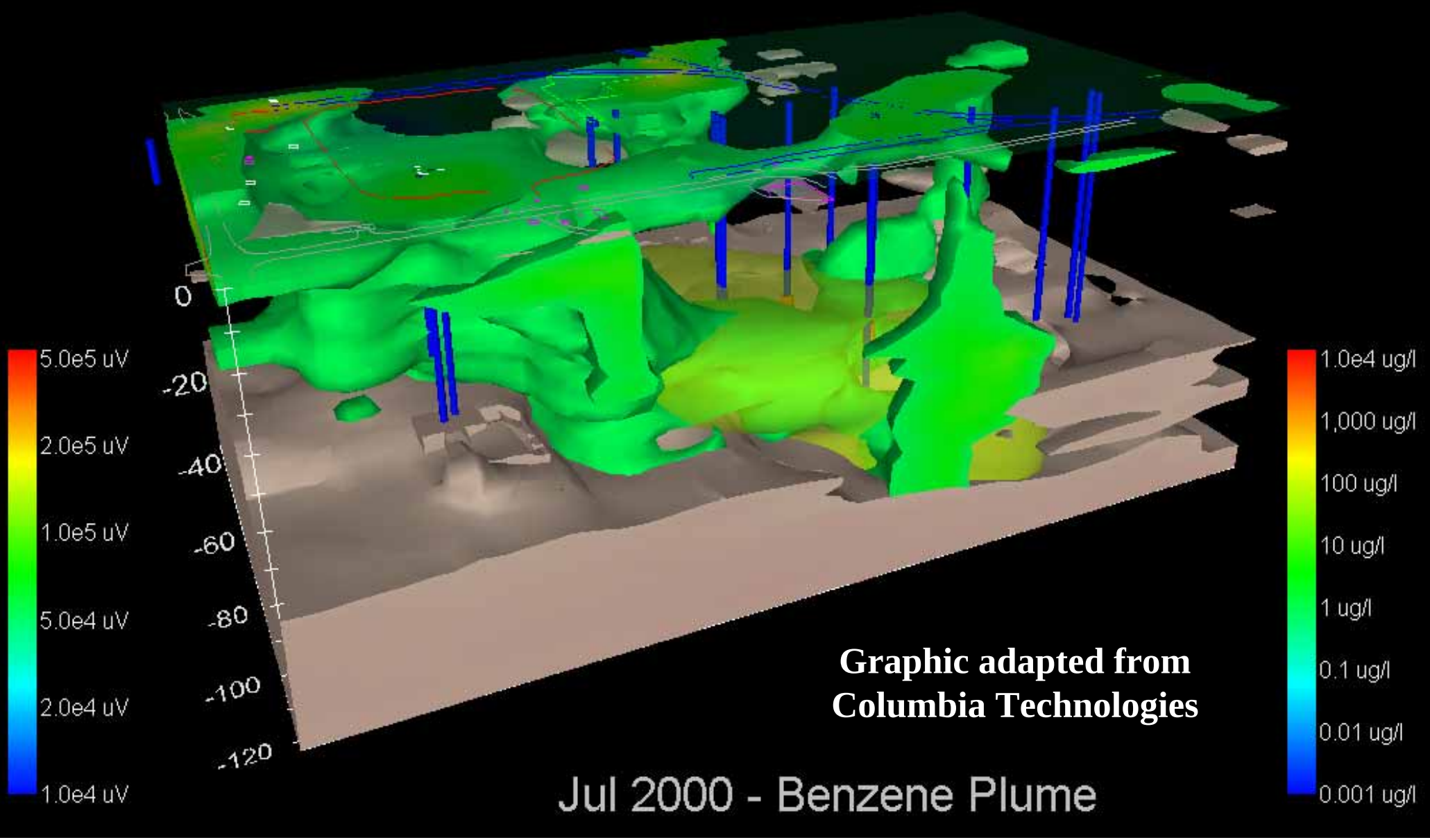
1) "Mgt of decision uncertainty" as the keystone

2) Project-specific conceptual site models

3) A 2nd-generation data quality model

4) Modern tools & work strategies

Subsurface CSM from high density DP-MIP sensing



Triad Grounds "Data Representativeness" in the CSM & in the Decisions

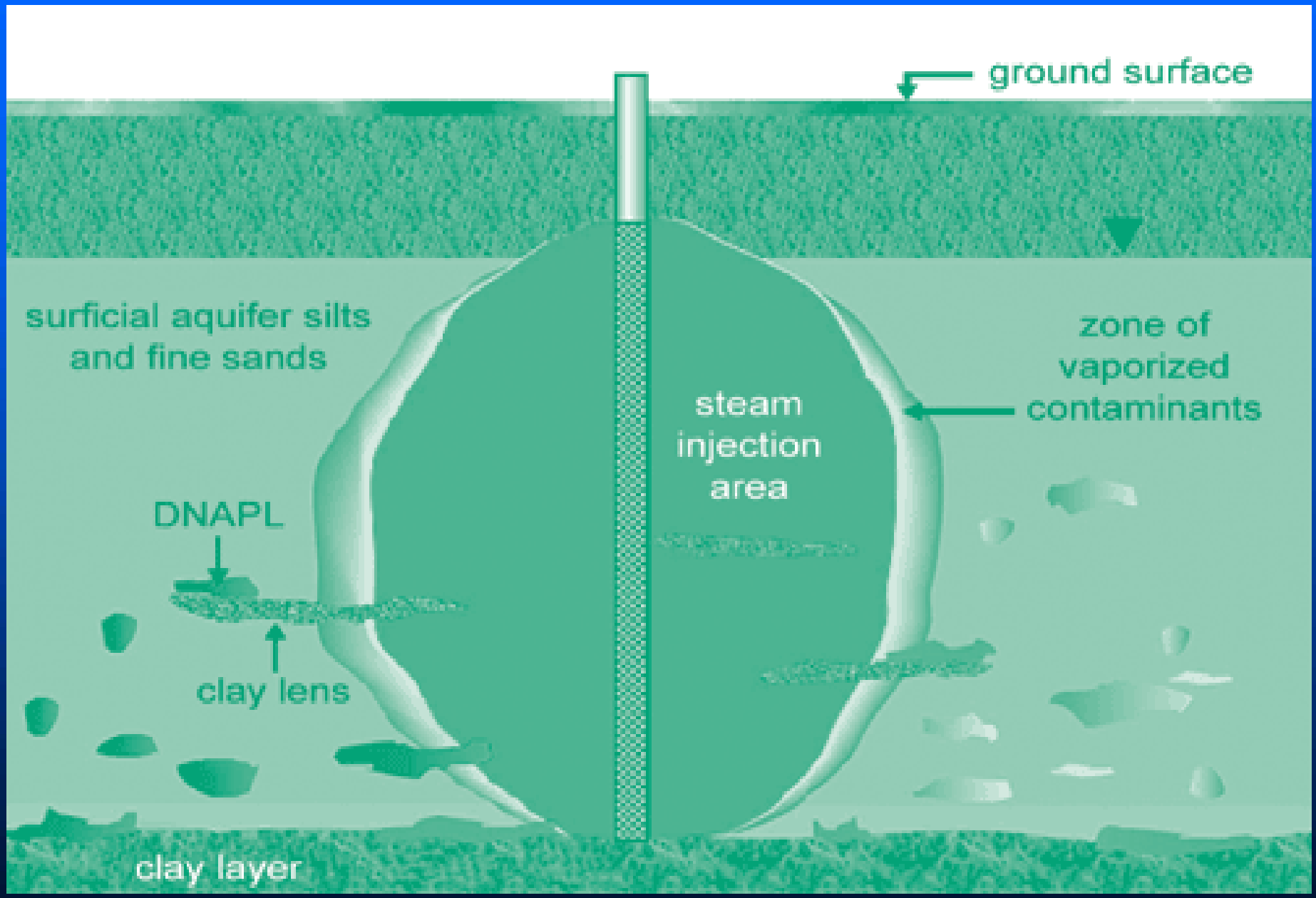
For example:

- Data set representative of contact over an exposure area should estimate the average concentration over the volume of the "exposure unit"
- Data set representative of an exposure pathway must detect & characterize a particular feature of interest (often not an average). For example:
  - » <200 mesh soil fraction is representative of dust exposure pathway, Pb conc = 2000 ppm
  - » "average" (homogenized bulk) soil Pb conc = 930 ppm (average will underestimate exposure

Representative Data Will Mirror the Scale of the Decision

- A data set representative of remedial design must provide information about concentration extremes & delineate spatial distributions at a scale that mirrors the scale of the remedial option.
  - » The scale varies depending on the decision & the remedial technology
  - » Contrast chemical oxidation with *in situ* heat treatment

Conceptual Model of DNAPL Treatment



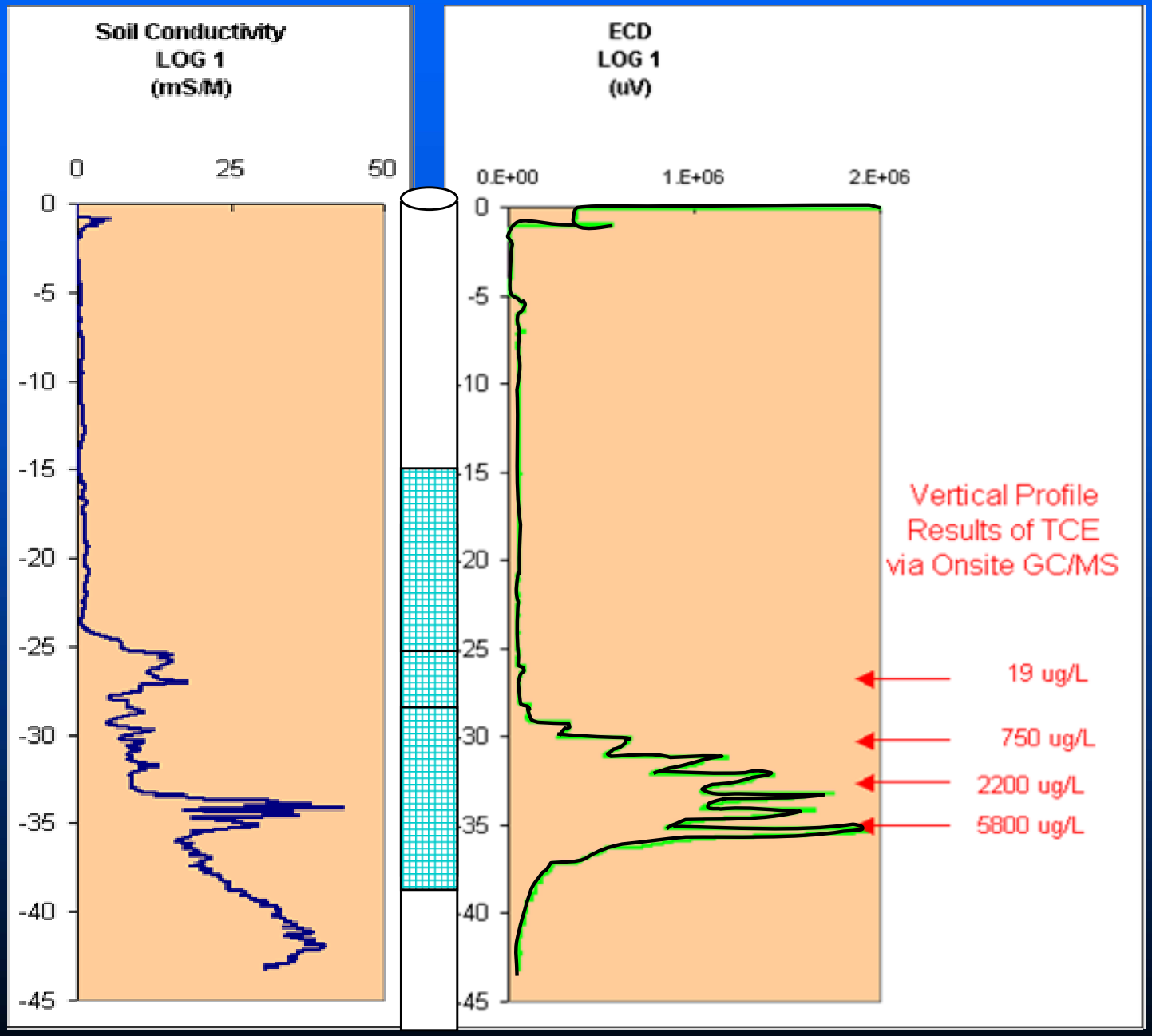
Ref: Technology News & Trends, 2004

Different decisions require different representativeness!

Generic Sampling Designs Cannot be Expected to Produce Representative Data for Heterogeneous Matrices

Impossible to specify a one-size-fits-all data set or one-size-fits-all sampling procedures that will be representative of all potential site decisions for heterogeneous sites.

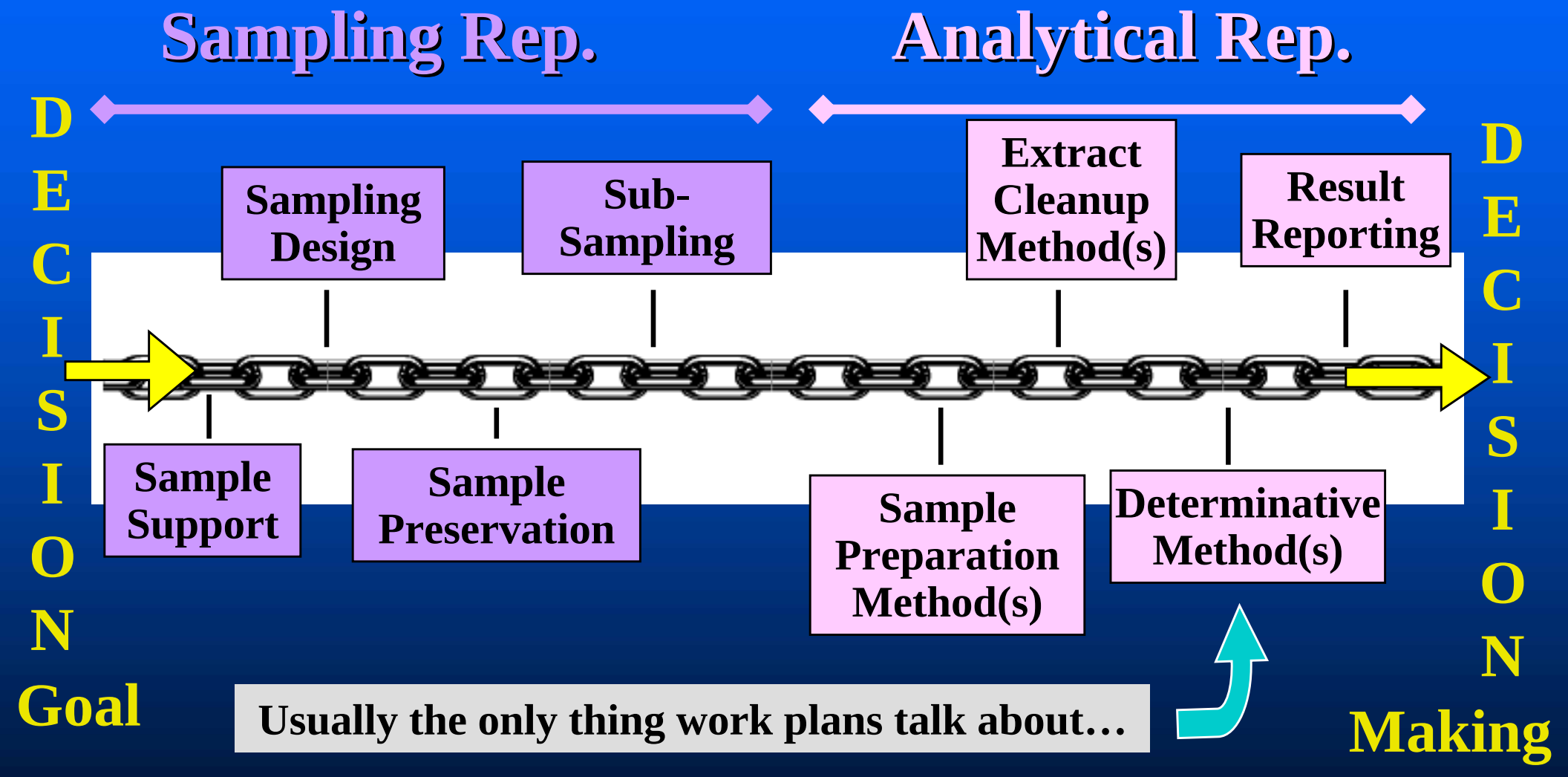
Different Sampling Procedures Can Drastically Change Analytical Results for GW



MIP = membrane-interface probe (w/ ECD detector)

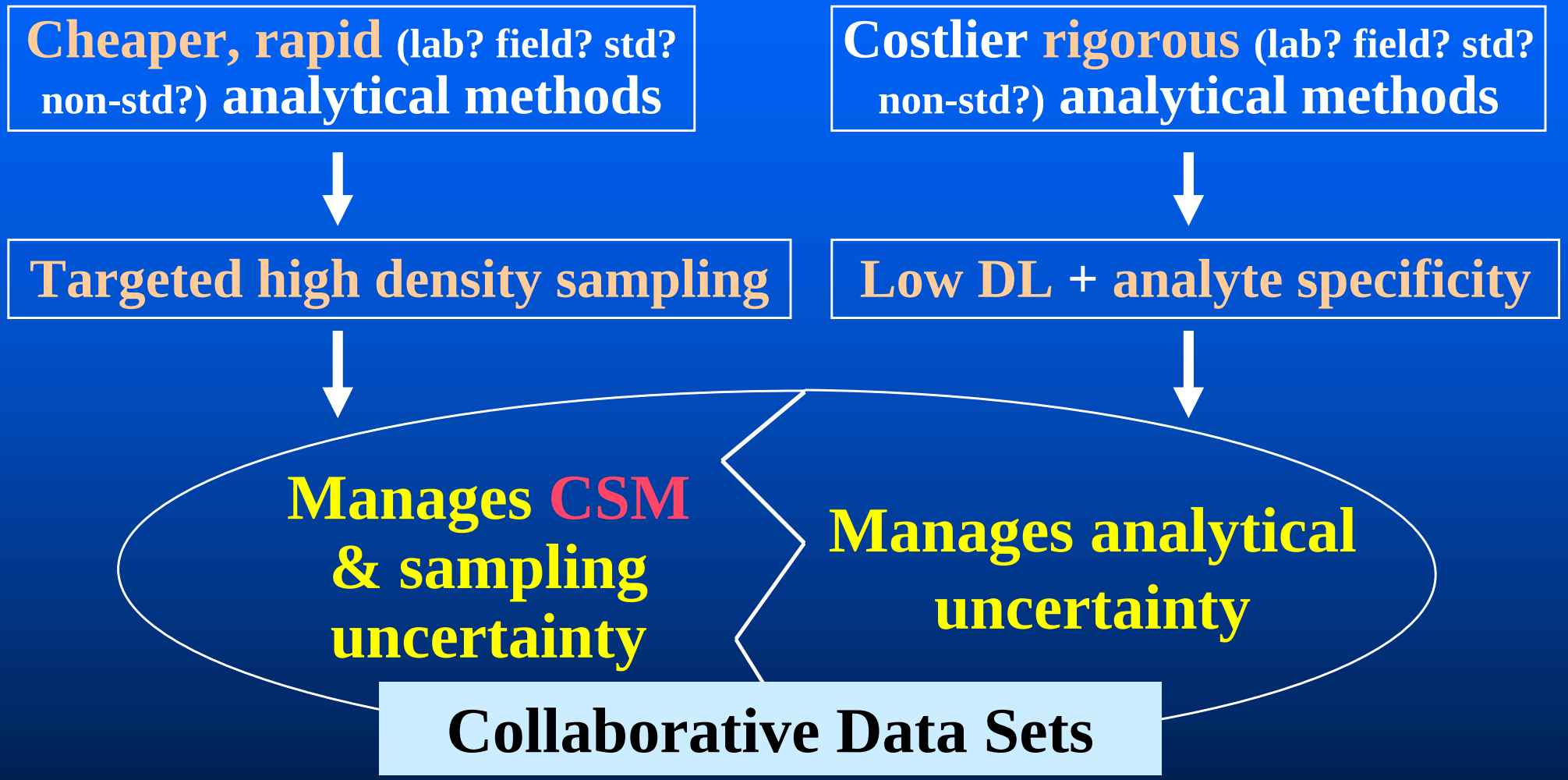
Graphic adapted from Columbia Technologies

A Data Quality Model that Ensures Data Representativeness



All links in the Data Quality chain must be intact for data to be representative of the decision!

Data Quality Model for Heterogeneous Matrices



Collaborative data sets complement each other so all sources of data uncertainty are managed

Triad is NOT…

- …written in all caps (not an acronym!)
- …just about using field analytical! (Warning: Just using field analytics does NOT mean Triad was used!!)
- …a way to justify using field analysis without using proper QC (MUST have data of known/documented quality!)
- …just about using a dynamic/flexible work plan (must actively manage decision uncertainty!)
- …taking 10 zillion samples (use your head & the CSM!)
- …a license to write vague work plans or escape regulatory oversight or accountability.

www.triadcentral.org

Glossary Go Search Site Go

Triad Overview | Triad Management | Regulatory Information | Technical Components | User Experiences | Reference/Resources

Privacy/Security

"The NJDEP supports and encourages the use of the Triad for sites undergoing investigation and remediation within the Site Remediation and Waste Management Program where feasible."

Evan Van Hook
New Jersey Department of Environmental Protection
Assistant Commissioner for Site Remediation and Waste Management


Multiagency support for Triad

Triad Resource Center

TRIAD: A SMARTER SOLUTION TO SITE CLEANUP

The Triad is an innovative approach to decision-making for hazardous waste site characterization and remediation. The Triad approach proactively exploits new characterization and treatment tools, using work strategies developed by innovative and successful site professionals. The Triad Resource Center provides the information hazardous waste site managers and cleanup practitioners need to implement the Triad effectively.

Triad Overview
Introduction to Triad key concepts, guiding principles, and benefits

Triad Management
Triad vs. traditional, cost estimation, procurement, QA/QC, logistics and implementation, and other management concerns

Regulatory Information
Legal defensibility, relationship to DQO process, QA/QC, and other regulatory issues

Technical Components
Triad and cleanup programs, systematic planning, dynamic work plans, real-time measurements, and other technical information

User Experiences
Triad projects map, case studies, and lessons learned

References/Resources
Triad documents, web links, training classes, and resource providers

News

- ITRC Releases Triad Guidance Document for State Environmental Protection Agencies

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Frequently Asked Questions

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The Challenge for Next-Generation Thinking

"The difficulty lies, not in the new ideas, but in escaping the old ones..."

—John Maynard Keynes
(English Economist, 1883-1946)