

***Streamlining Sampling and Analysis to
Support Site Cleanup: The Triad Approach***

**25 Years of Contaminated Land
Management:
*Achievements and Work Still to Be Done***

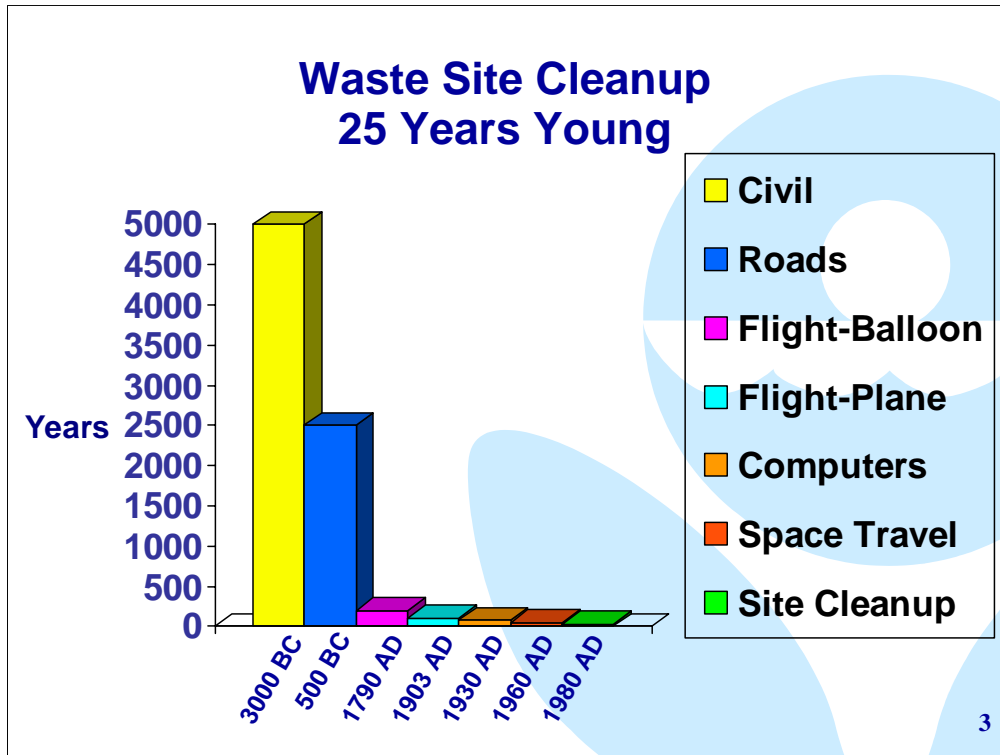
Bordeaux, France

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Changing Times in Site Cleanup

1980's

- ◆ Enforcement/litigation drivers
- ◆ Long timeframes, large budgets
- ◆ Repeatable processes
- ◆ Standard methods basis for analysis
- ◆ Limited applied knowledge/expertise
- ◆ Limited technology, early research
- ◆ Reliance on off-site, laboratory-based methods

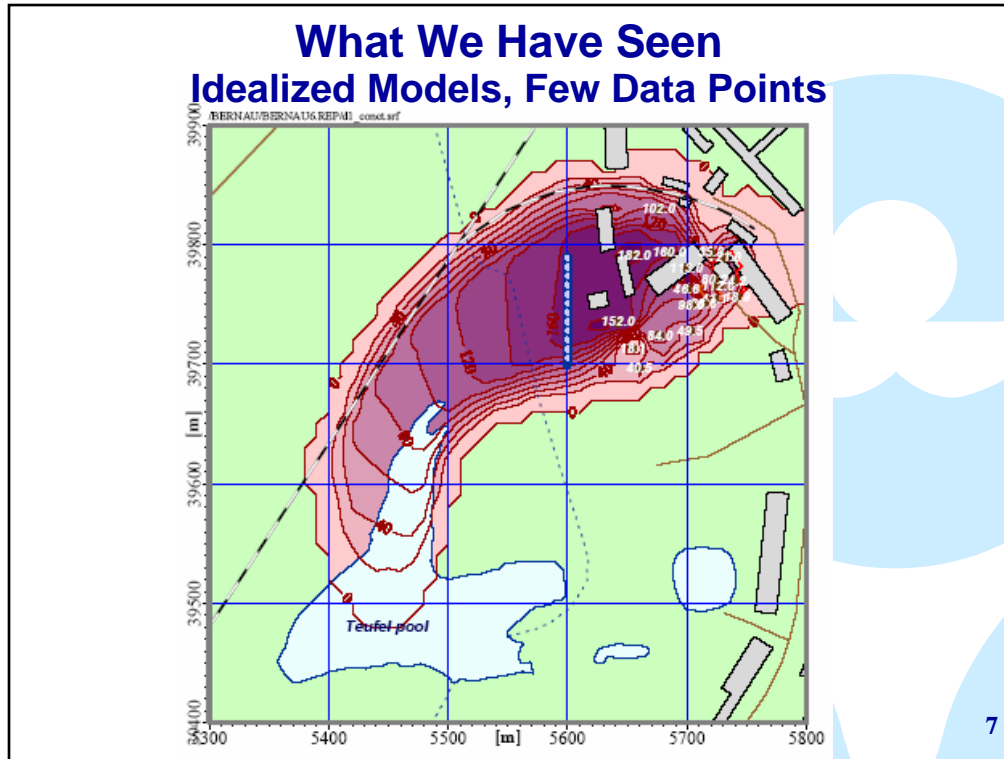
Present

- ◆ Land Recycling/Brownfields
- ◆ Faster, cheaper (limited budgets, real estate drivers)
- ◆ Site-specific needs
- ◆ Flexibility, performance basis
- ◆ Increasing knowledge base
- ◆ Rapid sampling/analysis tools
- ◆ Field methods provide both qualitative and quantitative results

Problem Statement

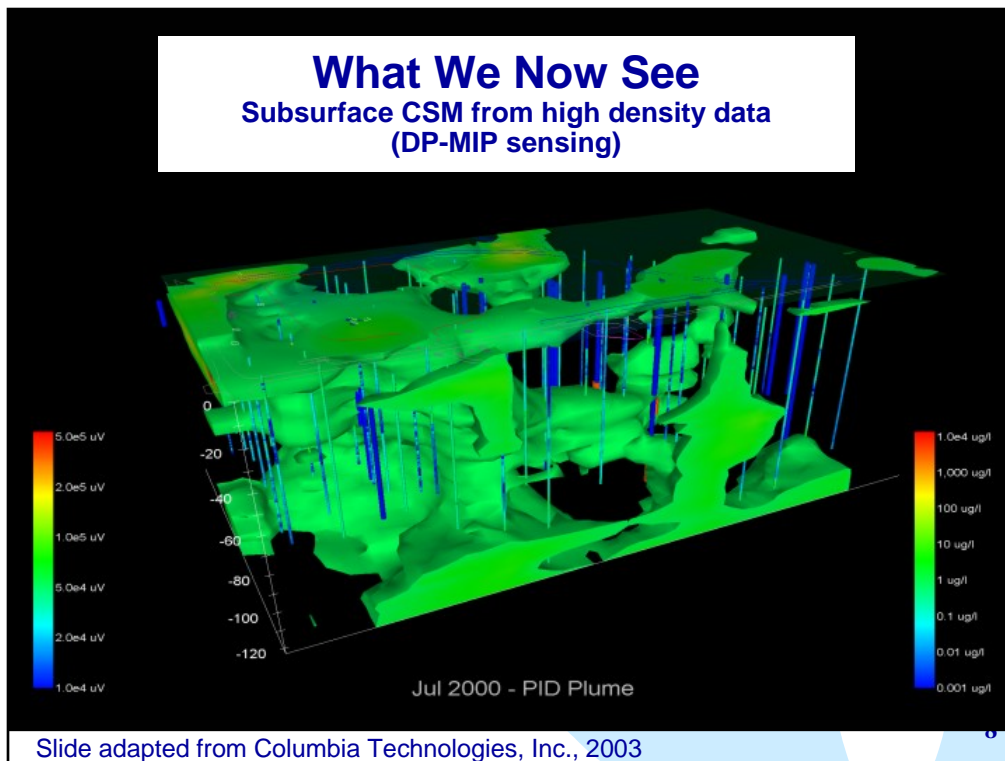
- ◆ Perception: contaminated site cost too much and take too long to cleanup
 - » Unexpected findings
 - » Regulatory processes
 - » Investigation – mobilization after mobilization; never enough data
 - » Cleanup – systems do not work as planned
- ◆ Unfortunately, that perception has basis in common experiences, often due to:
 - » Inadequate understanding of site conditions
 - » Insufficient management of all sources of uncertainty
 - » Lack of tools sufficient to affordably manage uncertainties



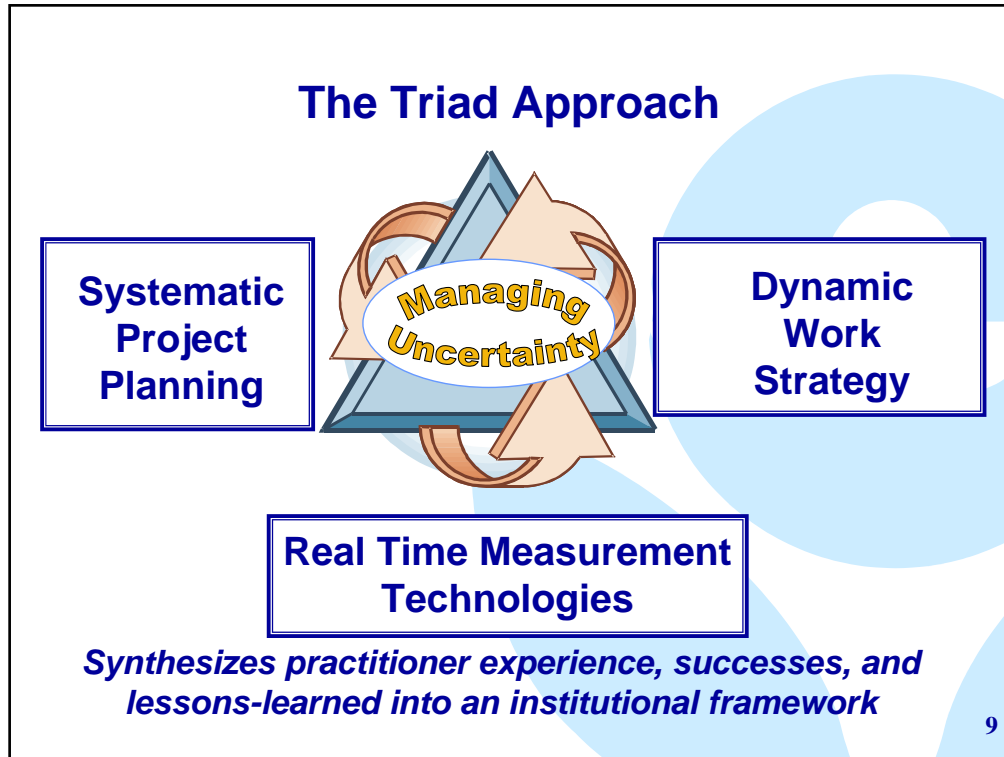


Common representation/depiction of a contaminant plume (TCE in this instance)

We are used to taking widely spaced samples and modeling groundwater plumes like this.



This is what the real world often looks like.



Systematic Planning

Site and decision-specific issues; charts best course to reach project goals

Dynamic Work Plans

Field based decision making allows for a seamless flow of site activities = fewer mobilizations

Guides data collection to support CSM

On-site Analysis Definitions of terms used during the course

Benefits of the planning process

Major planning steps

Applications of field-based sampling and analytical technologies

Documentation of accelerated approaches

Support Implementation of dynamic work plans

Technology/Methods/QC are based on data use and on-site decision making in mind

Triad Benefits Statement



Saves Time

- Fewer mobilizations
- Reduces debate
- Move through “stages” faster
- To closure
- To reuse



Saves Money

- Sampling events (*sometimes*)
- Cleanup/remedy
- Total project costs
- Reduce “overdesign”
- Insurance costs



Increases Confidence in Decisions

- Reducing Decision Uncertainty
- Representative
- Thoroughness (did we miss anything)
- All data users

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Systematic Planning Is Essential to.....

- ◆ Identify key decisions, decisionmakers, needs
- ◆ Identify and address (all sources of) uncertainty
- ◆ Develop data collection accordingly
- ◆ Adjust expectations according to:
 - » Evolving site needs
 - » New information
 - » Budget
 - » Schedule
 - » Community needs, goals
- ◆ Guide open, rational discussions on assessment, cleanup and reuse
 - » Possibilities
 - » Strategies

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Examples of Decisions

- ◆ Presence of contamination
- ◆ Types of contamination, contaminants of concern
- ◆ Extent (relevant to site goals)
- ◆ Location and extent of hot spots
- ◆ Costs/approaches of cleanup
- ◆ Receptors/pathways
- ◆ Cleanup levels
- ◆ Areas to develop for specific uses
- ◆ Performance of remedy
- ◆ Disposal options

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So How Is Triad “Planning” New?

- ◆ A formalized, integrated package that restructures how project planning and implementation are done:
 - » Focus: Identify and manage decision uncertainty
 - » Focus: Recognize the impacts of heterogeneity
 - » Front-loaded (anticipate vs. react)
 - » Conceptual Site Model essential; evolution guides field
 - » Integrated project team (understand data user needs)
 - » Start with end in mind (where are we going)
- ◆ Second generation approach maximizing improvements and advances in
 - » Knowledge
 - » Technologies

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Managing uncertainty not new: see 1994 EPA memo on SACM.

2) Concepts in the 2nd-generation data quality not new; but redefining the term “data quality” to include them is new.

Terminology clearly defined and anchored in decision uncertainty management to be logically and internally consistent: Term “field screening” out

3) Some tools brand new, others are not. Dynamic work strategies not new at all.

Social Capital and Triad Projects

- ◆ The “people” aspects of a project are critical
- ◆ Triad systematic planning encourages participants to:
 - » Share knowledge and insights
 - » Test assumptions, beliefs, and personal perspectives
 - » Evaluate legal, budgetary, and technical constraints
 - » Achieve clarity about where disagreements lie
 - » Negotiate over concerns and interests
- ◆ Facilitation needed if team doesn't possess the necessary social skills or if conflict and distrust too ingrained
- ◆ Uncooperative participants means Triad probably not a viable option for project management

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Pretty, Jules. Social Capital and the Collective Management of Resources. Science Vol 302 (12 Dec 2003) pp. 1912-1914.

Adams, W.M., D. Brockington, J. Dyson, and B. Vira. Managing Tragedies: Understanding Conflict over Common Pool Resources. Science Vol 302 (12 Dec 2003) pp. 1915-1916.

Why Emphasize Decision Uncertainty?

- ◆ Inherent in environmental decision making
- ◆ Always need to be managed
- ◆ Essential for accelerated progress
 - » Helps make decisions when “perfect information” is not available
 - » Resolution of all uncertainties or unknown conditions is unlikely
 - » Triad encourages distinction between significant and insignificant uncertainties
- ◆ Triad encourages teams to evaluate tradeoffs
 - » Counteracting uncertainties (RA contingency planning)
 - » Reducing uncertainties (additional data collection)

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The Triad and Data Quality

- ◆ Intensive systematic planning ensures project decisions and goals focused on exit strategy; all parties must understand them before fieldwork begins
- ◆ Experienced chemist an intimate member of planning & field teams
 - » Sets type & frequency of analytical QC procedures to ensure data reliability
- ◆ CSM used to capture heterogeneity & physical reality
 - » Mediates the mismatch between sampling /analytical scales (grams) an project decisions (tons)

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The Triad and Data Quality

- ◆ Data representativeness is KEY: defined in terms of CSM and decisions
 - » Use CSM (analyte variability) in conjunction with decision scale to determine proper sample support (the physical dimensions and volume of a sample)
 - » High sampling density or compositing often required: contamination typically heterogeneous; so infrequent sample results easily misleading
 - » Pre-project demonstrations of methods applicability (DMAs) ensure proper selection and application of tools to reach correct decisions
 - » Collaborative data sets generated throughout project (especially at critical decision points) to ensure continued agreement between field and lab results

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Directions and Experience From Theory to Practice

- ◆ Triad Profiles (14 now online, another 40+ under development)
 - » Real sites, completed work
 - » All shapes and sizes
 - » <http://www.triadcentral.org>
- ◆ Case Studies
- ◆ Experience, lessons learned

Triad: Real World Applications

- ◆ Brownfields sites
 - » Milltown, NJ
- ◆ Resource Conservation and Recovery Act (RCRA)
 - » Lockheed Martin Facility
- ◆ Superfund sites
 - » McCormick and Baxter
- ◆ UST Sites
 - » South Dakota
- ◆ State Cleanup sites
 - » Wenatchee Tree Fruit
- ◆ Department of Defense
 - » Avon Park, FL (USAF)
- ◆ Department of Energy
 - » Ashland FUSRAP Site

Summary/Cost Savings

- ◆ Average Time Savings: almost 2 years
 - Minimum: 6 months
 - Maximum: 3 years
- ◆ Average Cost Savings : 45% reduction in costs
 - Minimum: 35%
 - Maximum: 50%
 - Ex: One DoD site reported a cost avoidance of \$2.5M and 3 years saved
- ◆ All profiled projects have cited reduced costs and time savings due to: fewer mobilizations, shortened work schedule, and greater data density that reduces uncertainty at site

Changing Behavior and Perception

- ◆ Will require a change in how we have done business for 25 years
 - » Commitment to Triad planning; front-loaded, intense
 - » Very site-specific, decision-specific
 - » Innovations in procurement aspects
 - Flexibility
 - Planning
 - Contractor expertise, abilities (e.g., data management)
 - » Look at regulations, procedures
 - SW-846
 - No “boxes to check”
 - New guidance, support, expertise

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Change Is Good

- ◆ Evidence is pointing to fact that change is worth investment; does not mean we were “wrong”
 - » Lower TOTAL project costs
 - » Increase confidence in decisions
 - » Closure faster
 - Stages
 - Sites
 - » Lessen likelihood of unexpected findings, costs
 - Hidden cleanup costs (worse than we thought)
 - Regulatory delay
 - Lenders, insurers
 - » On to reuse, revitalization

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



"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."

*Joseph Seebode
New Jersey Department of
Environmental Protection
Assistant Commissioner for Site
Remediation and Waste
Management*



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**
- ▶ **Triad Management**
- ▶ **Regulatory Information**
- ▶ **Technical Components**
- ▶ **User Experiences**
- ▶ **References/Resources**

Glossary

FAQs

Acronyms

www.triadcentral.org

Training Information

◆ Remediation and characterization

» Internet seminars

- <http://clu.in.org/studio/seminar.cfm>
- Live and interactive
- Low time commitment (2 hours)
- No travel commitment
- Archived
- 163 seminars since 1998, over 21,000 participants, from over 900 cities in over 40 countries

◆ Classroom

- » <http://www.trainex.org>
- » <http://www.ert.org>