



... for a brighter future

An Introduction to the Triad Approach

*Real-Time Remedial Demonstration Project Kickoff
Meeting*

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U.S. Department
of Energy



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Triad Acknowledgments

The Triad approach is an EPA initiative, with active federal involvement by representatives from:



- The USACE



- The Navy



- The Air Force



- Argonne National Laboratory

3 Primary Best-Practice Elements of The Triad Approach/Framework



**Systematic
Project
Planning**



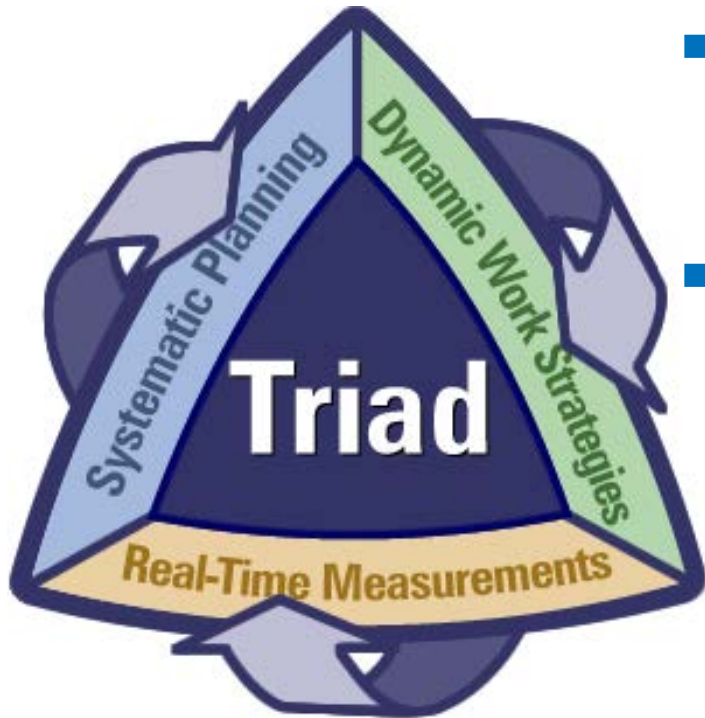
**Dynamic
Work
Strategies**

**Real-time Measurement
Technologies**

Managing Decision Uncertainty is the **keystone concept** for the 3 Triad elements

EPA's Triad Initiative

Contributing partners are located within EPA, DOE, DoD, ITRC, EU, private sector, academia [making up the Triad community of practice (CoP)]



- They develop
 - more clearly worded “messages”
 - education & outreach materials
 - TRC website & training courses
- They share lessons-learned from applying the latest science, work strategies & technology tools
 - provide technical support to other practitioners

www.triadcentral.org

“Is Triad New?”

Answer Depends on How You Ask the Question

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

No

If Ask the Question Another Way...

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

Yes

Triad Practice Encompasses More than Just Site Characterization

Triad is **NOT** exactly the same thing as expedited, accelerated, or streamlined site characterization!

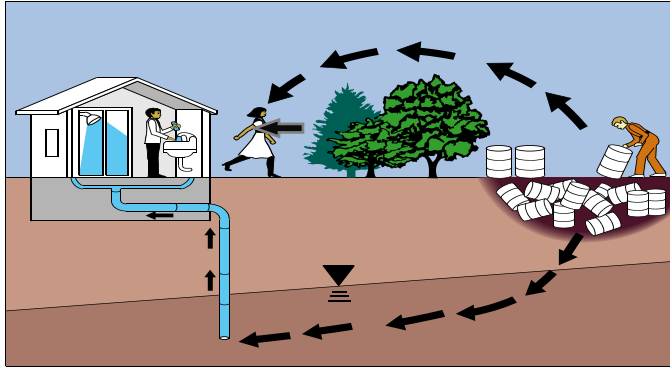
(although many of the same concepts are part of Triad)

Sites Cannot be Characterized in a Vacuum!

Lack of clarity here

Reuse Plans, Goals, Outcomes

CSM



Impact

...means uncertainty here

- Decisions:**
- Exposure risk
 - Cleanup goals
 - Data (type, quality)
 - Tolerable errors

...which means no foundation for agreement here

Determine

...or here

- Approaches to:**
- Assessment
 - Investigation
 - Cleanup Design, Implementation
 - Closeout, Long-Term Operations and Maintenance

- Tools for:**
- Sampling, Analysis, Interpretation
 - Cleanup/Remediation
 - Containment
 - Cleanup
 - Controls
 - Monitoring, Maintenance

So How Is Triad New?

It is an integrated package of tools & strategies that are synthesized from practitioner successes.

Applying the integrated package restructures how projects are planned & implemented.

Compared to conventional projects, Triad projects typically save 33 - 50% of a project's lifecycle time & costs.

For examples: see short summaries of 7 projects in the July 2004 Technology News and Trends newsletter at <http://www.triadcentral.org/ref/room/index.cfm>

What is the Goal of the Triad Initiative?

- Encourage adoption of 2nd-generation practices
 - Transitions are always difficult, but the benefits make the effort worthwhile
- “2nd-generation practices” refer to adopting modern characterization, remediation & monitoring strategies & technologies to improve CSM accuracy, cleanup efficiency, and confidence in exposure decisions.
- Doing so requires changes in associated practices, such as procurement, project planning, regulation writing & interpretation, and more.

Why are 1st-Generation Practices Outdated?

Compared to the 1980s when the current paradigm was created...

1. The science has grown & improved tremendously;
2. Technologies are more numerous & more advanced, and
3. Cleanup programs are well established and mature (this can both help & hurt transitions to new practices)

If we had the chance to...

- use better science & technologies to achieve cleanup program goals better & less expensively,

...wouldn't it be irresponsible not to?

The Triad Framework...

...bridges the disconnect between
what is now possible &
what is still done

The ideas embraced by the Triad approach have existed in some form for many years. The individual strategies, concepts & techniques have been tested by a wide variety of individuals & organizations, especially since the technology strides of the 1990s. The Triad framework synthesizes highly efficient strategies and technologies into an integrated package that is better aligned with current science and can be taught to new practitioners, defended to policy makers, & communicated to the public.

1. How Is the Science Better?

- Understand how the environmental and contaminant heterogeneity & behavior are far more complex **than imagined in the 1980s**
- The better our detection tools get, the more complexity and heterogeneity we find
- Now we can explain why our data sometimes doesn't make sense or misleads us into drawing conclusions later shown to be wrong
- Now we can list the factors that must be controlled for data to be firmly representative of the intended decisions

2. How Have Technologies Improved?

- Fixed lab techniques are more sophisticated; they can be more accurate if flexibility is allowed to adapt to actual data needs & site-specific matrix interferences
- Viable alternatives now exist to expensive & traditionally “slow” turnaround of fixed labs
 - Computerization & miniaturization have created rugged, portable instrumentation → cheaper, rapid analyses
 - Permits better control of sampling-related factors
- Advanced telecommunications support instantaneous transfer/sharing/processing/presentation of data

3. How Have Programs Matured?

- Established action levels & program expectations can aid up-front project planning
- Experience with 1st-generation model has (-)'s and (+)'s
 - (-) Structured procedures support the status quo, suppress change
 - (+) But, experience w/ programmatic & project problems can encourage acceptance of something better
- Popularity of Brownfields programs!!
 - Need to accomplish more w/ less (time & \$\$); repeating cycles of field work over many years until project completion not acceptable
 - Stakeholders expect defensible decisions; developers expect regulatory, economic/budgetary & timeframe predictability
 - Insurance premiums now capture long-term regulatory and technical uncertainty in short-term economic terms: creates incentives to aggressively identify & tackle uncertainties & avoid decision errors

The Founding Principle of the Triad Approach

- The central/keystone concept that links together all Triad strategies & practices is the concept of

Managing Decision Uncertainty

- Managing decision uncertainty does not always require gathering more data. Ask yourself:
 - Will any new data or information change your decision?
 - Can the decision process be structured so that additional data collection is not needed?
- When it is necessary & cost-effective to gather data to provide additional input to the decision process, then you will need to manage the data uncertainty that is relevant to the decision-making process.

Triad Essentials

- Must understand project decision goals
 - Why? Because you can't manage decision uncertainty without knowing what the decisions are
- Explicitly use conceptual site models (CSMs)
 - Why? Predicts what uncertainties are relevant to your decisions, how uncertain your data might be, and what factors need to be managed to reduce that uncertainty
- Use a skilled multidisciplinary project team
 - Why? Need people who 1) understand that uncertainties exist; 2) know how to identify which uncertainties are important, & 3) can develop a strategy to control them

Triad is NOT...

- ...written in all caps (it is not an acronym!)
- ...just about using field analytics! (Warning: Just using field analysis does not mean they used the Triad approach!!)
- ...a way to justify using field analysis without using proper QC (MUST have data of known/documentated quality!)
- ...just about using a dynamic/flexible work plan (must actively manage decision uncertainty!)
- ...a license to write vague work plans or escape regulatory oversight or accountability (adaptive work plan must be regulator- & stakeholder-approved).

Triad IS about...

- ...improving **project quality** by actively **managing decision uncertainty** using new tools & strategies
- ...constructing **accurate CSMs** (as a primary Triad product!) to support cost-effective decisions
 - Done in **real-time** to cut lifecycle costs
 - Guides control over sampling variables & tailoring **QC** to manage those data uncertainties relevant to project decisions
- ...avoiding uncertainty in **communications** with solid documentation and unambiguous terminology
- ...cultivating professional competence & multidisciplinary teams (“allied environmental professionals”) comfortable with **incorporating emerging science** into their routine practice.

Triad Projects are Rarely Easy

Triad projects are demonstrably “better, faster, and cheaper” than conventional...

But NO ONE is claiming they are easier!

- All aspects of project mgt (incl. budgeting, contracting, etc.) must support a Triad effort
- But institutional structures often pose barriers
- Extremely difficult to break away from traditional thinking

Accurate Conceptual Site Models (CSMs) are Key to Triad Projects

The CSM is THE Basis for Cost-Effective, Confident Decisions

- **CSM = the decision-maker's mental picture** of what's happening to contamination so decisions can be made about risk & cleanup
- A **CSM** is any tool that represents contaminant **populations** to make predictions about
 - Nature & extent of contamination,
 - Exposure to contamination, and
 - Strategies to reduce risks from contamination

DWS are a Product of Systematic Planning

- Cost effective means for addressing unacceptable decision uncertainty
- Require a clear articulation of
 - Project goals/decisions
 - Sources of uncertainty
 - Acceptable levels of uncertainty
- Grounded in CSM

DWS Can Cut Across Cleanup Activities

Increasing DWS Sophistication

- Selecting analytical options
- Determining sampling strategies, numbers, and locations
- Form and intensity of QC
- Course of remediation activities
- Overall characterization and remediation strategies

Successful DWS Affects Field-Work Planning and Implementation

- Strategies employed
- Cost estimation
- Contracting
- Logistics
- Collaborative data usage
- Decision-making framework
- Data management



Examples of Triad-Friendly Sampling Strategies

- Collaborative data sets w/ analytical options based on investigation levels
- Multi-increment sampling for controlling short-scale heterogeneity
- Adaptive compositing strategies
- Adaptive or sequential sampling methodologies

Where is Triad Now?

- Lots of examples of successful Triad projects
- Embraced by the Superfund program
- Individual EPA Regions identifying projects to “showcase” Triad concepts