UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OSWER-9200.1-55

SEP 1 - 2006

MEMORANDUM

SUBJECT: Advancing Best Management Practices: Applying the Triad Approach in the Superfund Program

FROM: Charles H. Sutfin, Acting Director
Office of Superfund Remediation and Technology Innovation (OSRTI)

James Woolford, Director
Federal Facilities Restoration and Reuse Office (FFRRO)

TO: Superfund National Policy Managers, Regions 1-10
Regional Science and Technology Directors, Regions 1-10

PURPOSE

The purpose of this memorandum is to request your cooperation in our effort to expand the use of the Triad approach to save time and money in the Superfund program where appropriate. The term Triad represents three main elements: systematic planning, dynamic work strategies, and innovative rapid sampling and analytical technologies. Triad encompasses the field experience and management practices of project staff who have found ways to improve or streamline site cleanup, and captures these processes into a comprehensive approach. Specifically, we are asking each Region to name a staff contact to serve as the Superfund Regional Triad Lead, who would coordinate ongoing and future Triad efforts in their Region and serve on a new Superfund Triad Workgroup, and to nominate at least two Superfund sites at which to initiate use of the complete Triad process during 07.

BACKGROUND

While elements of the Triad have long been used for site cleanup, Triad packages them together into a comprehensive framework. The common principles or practices present in site cleanups incorporating these elements include:

1. A thorough systematic planning process, which includes participation of all stakeholders (including a multidisciplinary project team, federal and state regulators, legal counsel, community members, and other environmental professionals), to determine the types of data required and to evaluate whether the

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site could benefit from utilizing a dynamic work strategy and real-time measurement technologies.

2. Transparent, open, candid discussion of uncertainty management, data representativeness, and site closure strategies that are continually refined throughout the project lifecycle.

3. A continually evolving conceptual site model that recognizes site characterization is an element utilized at all stages of remediation, and is updated through a dynamic work strategy.

4. Use of innovative sampling, measurement, and data management technologies to support uncertainty management strategies that address heterogeneity.

5. Project teams that have effective communication, trust, open discussion of individual interests and goals, and diverse expertise in the appropriate fields (i.e., high social capital)

Additional information on Triad, including guidance documents, scheduled courses, educational videos, internet seminars, and other educational opportunities, can be found at the Triad Resource Center Internet site at http://www.triadcentral.org. Attachment 2 also provides more information on the Triad process.

The first step in the Triad approach is systematic planning, and the resulting work plans include a Quality Assurance Project Plan (QAPP). A sound QAPP greatly facilitates Triad projects by clearly recording the project team's plans for reaching project goals. A recent Office of Solid Waste and Emergency Response (OSWER) policy directive[1] recommends the use of the format and templates in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) to document project systematic planning for federal facilities. The UFP-QAPP, developed by an interagency workgroup, offers a variety of time-and-cost-savings and data quality benefits. For this reason, EPA Regions and Triad practitioners are transitioning to this format. We encourage those who will be applying Triad to participate in UFP-QAPP training (offered by OSWER and the US Navy) when it is provided in regional offices or nearby Department of Defense (DoD) facilities.

The Triad approach is not confined to the Site Inspection/Remedial Investigation (SI/RI) phases of the cleanup process. Triad recognizes that site characterization (i.e. an improved conceptual site model) is an element utilized at all stages of remediation, not just the pre-Record of Decision (ROD) phase. With its emphasis on reducing decision uncertainty, Triad can provide great savings during the remedial design (RD) and remedial action (RA) phases and can be useful in the post-construction completion (PCC) stage as well. Attachment 3 lists Brownfields, Superfund, federal facility, and other sites where Triad is contemplated, ongoing, or completed. The Triad Project Profiles on the

[1] OSWER Directive 9272.0-17, http://www.epa.gov/fedfac/documents/intergov_qual_task_force.htm

Triad Resource Center website has more details on completed Triad projects (http://www.triadcentral.org/user/index.cfm).

IMPLEMENTATION

We are moving ahead with an effort to expand Triad expertise and to support Triad projects in the Superfund program in each Region by the end of FY 07. Such a step is essential to develop expertise among staff across the Regions and to identify and work through any issues that adoption of Triad may present in the context of Superfund. The activities proposed here are meant to broaden the participation and input of Regional Superfund and quality assurance management and staff.

Regional Superfund Triad Lead

We are asking you to nominate a Regional contact to serve as technical lead for the Triad in the Region and to participate in a new Superfund Triad Work Group. This workgroup will be an initial step in building a larger pool of expertise within Regions and ensuring that we have a continuing dialogue on new and evolving practices related to site cleanup. Just as Triad emphasizes the need for multi-disciplinary teams, we are looking for Regional staff with varied backgrounds. The Regional Triad Lead should have competencies in one or more of the following areas related to Triad implementation: Superfund project management, contracting, budget, risk assessment, sampling and analysis, cleanup approaches, decision support tools, and quality assurance. Responsibilities will include participation in monthly or bimonthly work group calls and one face-to-face meeting per year; documentation and dissemination of Triad information in the Region; advising on Triad applicability; and helping to apply Triad at specific sites. In addition, this person may help develop, or provide comment on, resources and training related to Triad.

The Superfund Triad Work Group will allow a regular dialogue across Regions and between Headquarters and Regional staff to advance application of the program within Superfund. The work group will identify candidate sites and key issues, and coordinate the dissemination of information and training to Regional staff. We believe this group will play a key role in coordinating with Superfund staff across the country to ensure the lessons learned at one site are carried forward to other sites and to build hands-on experience across projects. This will include identifying needed Triad process improvements for the Superfund program. The work group will also coordinate with the existing Triad community of practice (CoP), made up of Triad practitioners from other program areas (e.g., Brownfields, Resource Conservation and Recovery Act (RCRA) corrective action, Underground Storage Tanks).

Superfund Triad Kickoff Sites

As noted above, we are also asking you to identify at least two Superfund sites in your Region to serve as a Triad kickoff projects during Fiscal Year 2007. Sites do not have to be at the beginning of the pipeline to allow application of Triad. Triad has been effective at sites in the RD phase and further data collection is necessary; at sites where RAs are underway where remedy effectiveness needs to be evaluated or contaminant plumes need to be better delineated; and at sites where long-term monitoring is occurring. A Superfund site where Triad planning or field work is underway may be nominated as one of the kickoff sites. We will provide the appropriate support resources to facilitate Superfund Triad projects from our Triad support network. These include the Office of Research and Development (ORD), the Army Corps of Engineers, Argonne National Laboratory, and EPA contractors. We expect that a Triad project summary report will be generated to help document lessons-learned and cost and performance.

Please provide Dan Powell, Chief of the Technology Integration and Information Branch, with your nominees (and contact information) for the Superfund Triad Lead and site nominations by October 31, 2006. Dan will then contact each person and arrange a conference call of the Superfund Triad Work Group to establish areas of interest and both near-term and long-term goals and actions. Once the group is in place, they can develop a plan of action to advance the goal of mainstreaming Triad in the Regions. You can email this information to Dan at powell.dan@epa.gov, or call him at (703) 603-7196.

Conclusion

Based on the proven results from projects utilizing the best management practices embodied in the Triad approach, we feel it is time to move ahead with broader application of the Triad approach across Superfund and across the Regions. We look forward to hearing from you on your nominees for the Regional Superfund Triad lead and on your candidate Triad sites. The process outlined here is meant to promote the open and frank dialogue required to successfully incorporate Triad into our important work of cleaning up Superfund sites. If you have any questions or comments please feel free to contact Walter Kovalick, Director of the Technology Innovation and Field Services Division in OSRTI, or to contact Dan Powell. We look forward to working with you.

Attachments

Cc: OSWER Office Directors
OSWER Deputy Office Directors
OSRTI Division Directors
OSRTI Branch Chiefs
Mike Carter, FFRRO
Regional Quality Assurance Managers
Hazardous Substance Technical Liaisons
TSP Forum Co-chairs
Federal Facility Leadership Council, Regions 1-10

Attachments

1. Superfund Triad Support Team Fact Sheet
2. Triad Fact Sheet
3. List of Triad Sites

Attachment 1
Superfund Triad Support Team Fact Sheet

Superfund Triad Support Team

EPA staff may request site-specific support for Superfund sites from the Superfund Triad Support Team (STST) at no cost. Nongovernment organizations are limited to information requests only.

1. Review and assist in development of project documents such as requests for proposals, work plans, field sampling plans, quality assurance project plans, and engineering design reports. The STST is available to review these types of documents with regard to technology options, implementation processes, and the potential for incorporating one or more elements of the Triad approach.

2. Facilitate systematic planning processes and provide resources for the **development of conceptual site models (CSM)** during systematic planning meetings.

3. Provide information about the use of innovative and field-based technologies for site investigations and cleanups. The STST can provide information about specific technologies or types of technologies for use during site investigation and cleanup activities. These activities can include field-based measurement techniques, off-site analytical techniques, and innovative or conventional techniques for cleaning up contaminated soil or groundwater at a site. The STST can identify applicable technologies and provide brief analyses of their potential advantages and limitations in light of site-specific features and needs. Moreover, technology information can be provided for a broad range of audiences, including technical and nontechnical stakeholders.

Other Resources

- Understanding Procurement for Sampling and Analytical Services Under a Triad Approach (June 2005) EPA 542-R-05-022
- Use of Dynamic Work Strategies Under a Triad Approach for Site Assessment and Cleanup - Technology Bulletin (September 2005) EPA 542-F-05-008
- Using the Triad Approach to Improve the Cost-Effectiveness of Hazardous Waste Site Cleanups (October 2001) EPA 542-R-01-016

Attachment 2
Triad Fact Sheet

Improving Sampling, Analysis, and Data Management for Site Investigation and Cleanup

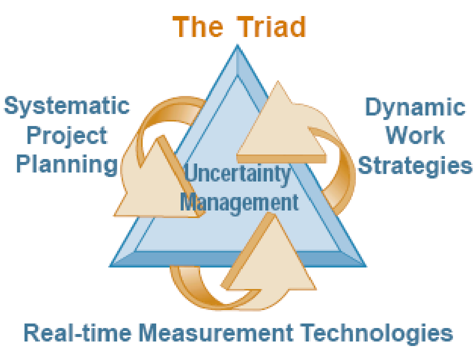
The United States Environmental Protection Agency (EPA) supports the adoption of streamlined approaches to sampling, analysis, and data management activities conducted during site assessment, characterization, and cleanup. This position reflects the growing trend toward using smarter, faster, and better technologies and work strategies. EPA is coordinating with other Federal and State agencies to educate regulators, practitioners, site owners, and others involved in site cleanup decisions about the benefits of a streamlined approach. Ultimately, EPA expects to institutionalize these newer approaches and anticipates that the principles will guide the way data are collected and analyzed for future site cleanup decisions.

The Triad Approach

The trend toward modernization and streamlining relies on a three-pronged aproach called the ***Triad approach***. The cornerstone of the Triad is the explicit identification and management of decision uncertainties. A primary Triad product is an accurate conceptual site model (CSM) that delineates distinct contaminant populations for which risk estimation and cost-effective remedial decisions will differ. The main elements of the Triad are

▲ ***Systematic project planning*** for all site activities, ensuring that end goals for a project are clearly identified. Once goals are defined, systematic planning involves charting the most resource-effective course to reach those desired outcomes. A team of *multi-disciplinary, experienced technical staff* works to translate the project's goals into realistic technical objectives. The CSM is the planning tool that organizes what is already known about the site and helps the team identify what more must be known to make project decisions. The systematic planning process ties project goals to the necessary data collection and remediation activities by identifying information gaps in the CSM. The team then uses the CSM to direct field work, updating the CSM as site work progresses and data gaps are filled. The CSM is the key integration tool for:

★ Understanding contaminant release, fate, and migration mechanisms to predict contaminant distributions and spatial patterns;
★ Predicting exposure and designing cost-effective risk management strategies;
★ Planning site activities;
★ Modeling and data interpretation; and
★ Communicating among the team, decision makers, stakeholders, and field personnel.



▲ A ***dynamic work strategy***, often in the form of a regulator-approved decision tree, guides project teams in making decisions *in the field* about how subsequent site activities will progress. Real-time decision making requires sufficiently rapid ("real-time") turnaround of data. Success of the "dynamic" approach hinges on the presence of *experienced staff* empowered to "call the shots" while work crews are still in the field based on the decision logic developed during the planning stage. Field staff maintain close communication with project oversight during implementation of the dynamic work plan and to address any unanticipated issues.

United States Environmental Protection Agency
Office of Solid Waste and Emergency Response (5102G)
EPA-542-F-04-001a
April 2004
www.epa.gov/tio
www.cluin.org

▲ ***Real-time measurements*** might be generated in the field or in a fixed laboratory. In addition to analytical techniques, the term includes rapid sampling platforms (e.g., direct push technologies), geophysical tools, and on-site data management and display software that makes real-time decision making possible. The capabilities of advanced information technology (IT) tools permits rapid sharing of data among interested parties no matter where they may be physically or geographically located. During up-front planning, the team identifies the types, rigor, and quantities of data needed to answer the questions raised by the CSM. Those decisions then guide the design of sampling plans that address data representativeness issues stemming from environmental heterogeneity. Analytical methods are carefully mixed-and-matched to focus data collection on maturing the CSM and providing data that are representative of the decisions to be made.

Figure 1 illustrates the iterative and interlinked nature of projects managed using the Triad. The decision rules developed during systematic planning are built into the work and sampling plans. Occasionally, decision makers will discover that the original project objectives cannot be met due to technical or budgetary constraints, and pragmatic refinement of the decision rules may be needed.

Supporting Developments

Faster, cheaper, yet still protective, resolution of contaminated sites is achievable by adopting new technologies and the new strategies those technologies support. If used correctly, innovative rapid-turnaround field analytical and software tools coupled with on-site decision making can significantly condense a project's overall budget and lifetime, while significantly increasing the likelihood that the gathered data will guide better, more transparent decisions. Site professionals, policy makers, and the public should support the flexibility needed to adopt cost-effective new tools and strategies into improved site cleanup practices in conjunction with clearly defined performance goals. Economics, site redevelopment, and regulatory evolution are driving trends toward modernization and streamlining. Technology advancement and 25+ years of site cleanup experience are pointing toward a next-generation environmental data quality model that includes explicit management of sampling uncertainties by grounding them in the decision context. Specific developments that support modernization include:

★ ***Field analytical chemistry*** has made significant advances in scientific rigor and credibility. Computerization, photonics, miniaturization, immunochemistry, and a host of other advances in the chemical, biological, and physical science disciplines are contributing to technology improvements and innovations. When field methods are used, proactively managing any excessive analytical uncertainty requires educated staff and quality control that is solidly grounded in the project decisions.

★ Successes with ***various streamlining initiatves*** such as Expedited Site Characterization (ESC), Accelerated Site Characterization (ASC), Rapid or Adaptive Site Characterization (RSC), and Adaptive Sampling and Analysis Programs (ASAPs) demonstrate the validity and cost-effectiveness of principles that are captured within the Triad framework.

★ ***Regulatory policies*** are focusing more on achieving tangible end-results. For example, EPA and other agencies support performance-based measurement systems (PBMS) as a preferred alternative to rigidly prescribing which analytical tools are used and how. PBMS principles support the use of field analytical technologies to meet the specified project needs and decision goals.

★ ***Evolving emphases in environmental programs*** [such as Brownfields, State Voluntary Clean-Up Programs (VCPs), and Base Realignment and Closure (BRAC) at military facilities] focus site activities on how the site will be redeveloped or reused. Flexible cleanup goals [such as risk-based corrective action (RBCA) levels] can be tailored to meet specific reuse objectives. When cleanup and end-use goals are articulated at the start, systematic planning can ensure a cost-effective work plan that achieves the desired outcome. Added focus on redevelopment and the involvement of insurance, banking, real estate and land use planners create market incentives for identifying and managing all uncertainties that could delay or derail a project.

★ ***Better decision-making tools (i.e., computer software and hardware)*** facilitate rapid data management, statistical processing, and interpretation as data are being generated. These capabilities allow display and modeling of contaminant distributions and maturation of the CSM in real-time. The project team can rapidly incorporate data, modify site characterization activities, and refine cleanup decisions to target contamination and minimize repeated field mobilizations.

★ ***Modern communication technologies*** mean that the field team is no longer isolated from regulators, technical experts, site owners, and trustees. Newly developed information can be shared instantly among distant parties, while regulator buy-in and technical support can be obtained from remote locations, allowing high level staff to spend less time being physically in the field.

★ ***Increasing workloads and decreasing budgets*** have forced regulators and industry to consider innovative strategies that can increase public confidence and satisfaction by reducing uncertainties (about any threats the site may pose) while reducing the time and costs involved in cleaning up these sites.

Tools for Change

To accomplish change, the remediation industry and regulators should move toward a more innovation-friendly system that can produce defensible site decisions at an affordable cost. Such a system would:

✓ ***Focus on decision-specific performance*** requirements, rather than inflexible adherence to traditional policies or "boiler-plate" procedural checklists that do not add value or provide beneficial results. In particular, oversight must evaluate data quality as a function of ***both*** sampling and analytical uncertainties as they contribute to development of an accurate CSM, not simply as a function of the analytical method used or the location (on-site vs. off-site) where the data is generated.

✓ Employ ***transparent and logical reasoning*** to define project goals, manage uncertainties, state assumptions, plan activities, and derive conclusions so that decisions are defensible.

✓ Value technical proficiency in environmental practice through teams of ***"allied environmental professionals"*** that collectively possess the scientific, mathematical, and engineering disciplines required to competently manage the complex issues of hazardous waste sites.

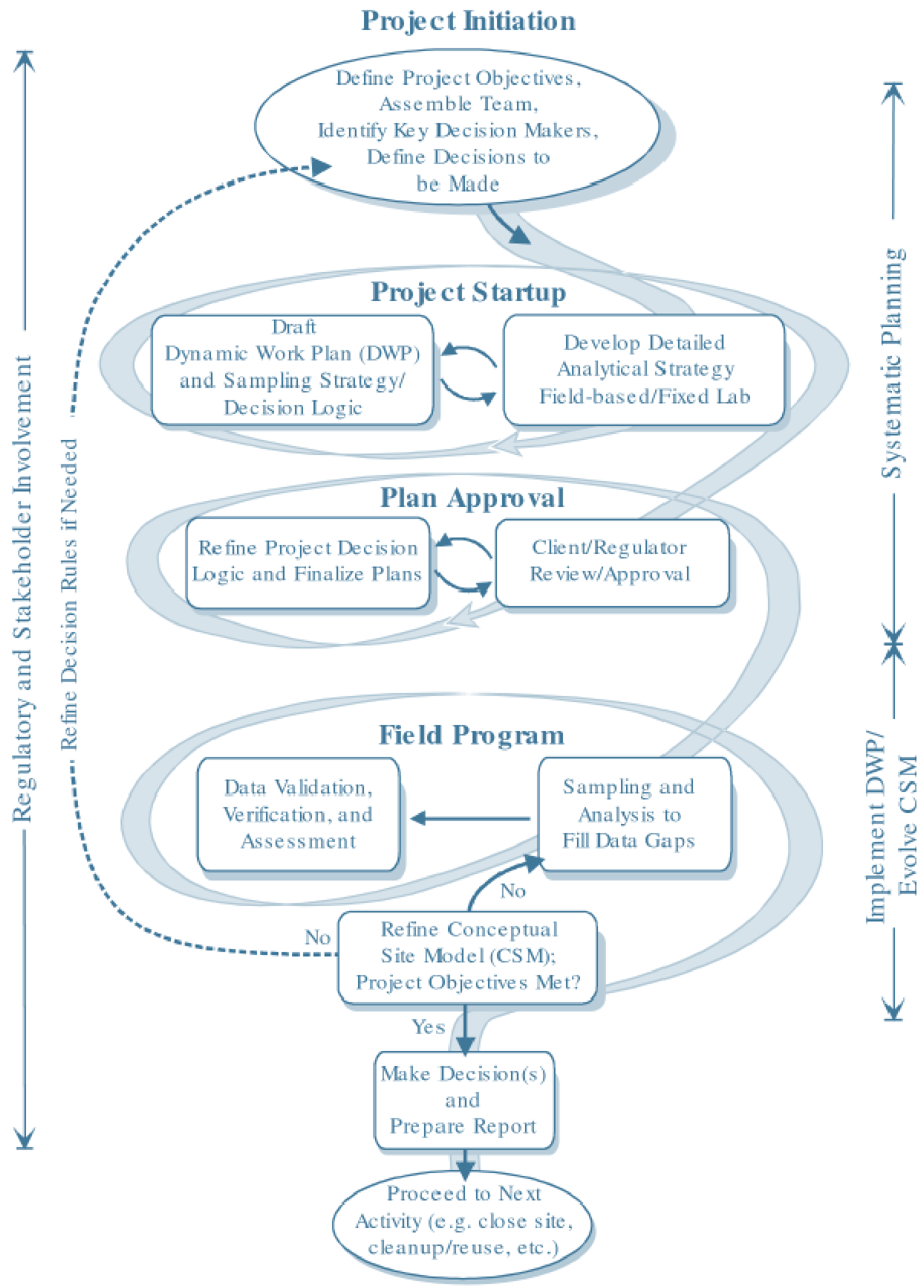
✓ Facilitate application of ***innovative technologies and strategies*** by logically evaluating project-specific needs, site conditions, and prior technology performance, with residual areas of uncertainty being identified and addressed before use.

A handful of practitioners have been successfully using the Triad approach, although many ***institutional and regulatory hurdles*** still exist. EPA is encouraging project managers and regulators at-large to evaluate how Triad principles can be adopted into routine practice.

EPA is collaborating with Federal and state partners to accelerate policy development and information dissemination in support of a shift to newer, streamlined approaches. An array of educational, training, and guidance resources already exist and additional ones are in development. Access to these resources is provided through the http://cluin.org/triad website and are detailed in the companion fact sheet, ***Resources for Strategic Site Investigation and Monitoring***, **EPA-542-F-04-001b.**

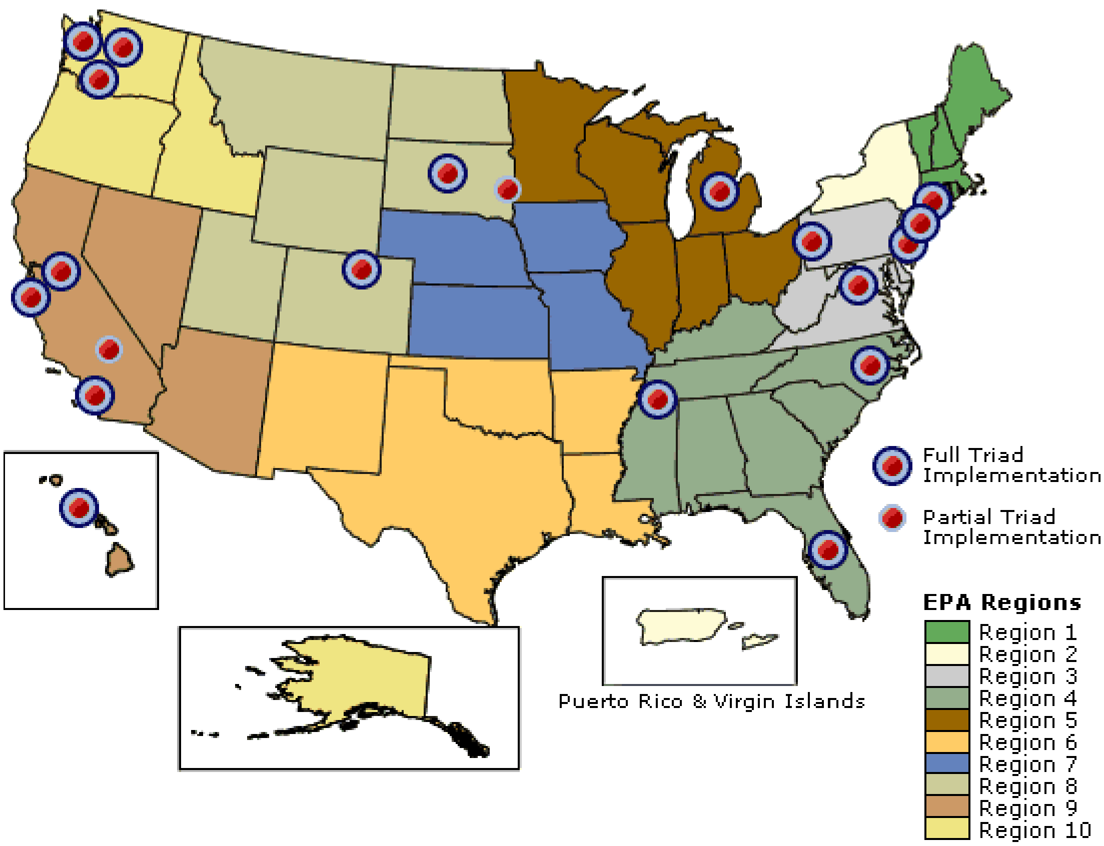
Updating hazardous waste site practices to accommodate new tools and strategies has broad ramifications for both practice and policy. Revising institutional and regulatory barriers will take time and effort. Nevertheless, the protective and cost-saving benefits offered by next-generation strategies make the effort worthwhile.

Figure 1
Modernizing Site Characterization and Monitoring



Attachment 3
List of Triad Sites

The following projects have been documented as using elements of the Triad approach at the Triad Resource Center. This list is not inclusive of all completed, underway, or planned projects. Information on each project can be found online at http://www.triadcentral.org/user/index.cfm



1. Expedited Characterization of Petroleum Constituents and Polychlorinated Biphenyls Using Test Kits and Mobile Laboratory Gas Chromatography at Former Cos Cob Power Plant, Greenwich, CT

2. Site Investigation for Metals and PCBs Using ICP and GC in a Mobile Laboratory at the Marino Brothers Scrap Yard, Rochester, PA

3. Use of Field-Based Methods and Dynamic Work Strategies for Characterization of Petroleum Constituents, Polychlorinated Biphenyls, and Metals at the Crescent Wire Property, Assunpink Creek Greenway Project, Trenton, NJ

4. Systematic Planning and Conceptual Site Model Case Study Basewide Hydrogeologic Characterization Naval Air Weapons Station (NAWS) China Lake Ridgecrest, CA

5. Use of Field Portable X-Ray Fluorescence (FPXRF) and the Triad Approach To Investigate the Extent of Lead Contamination at a Small Arms Training Range, Fort Lewis, WA

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6. Use of Immunoassay, Gas Chromatography, and Inductively Coupled Plasma Spectrometry (ICP) to Detect Pesticides in Soil, East Palo Alto, CA

7. Use of Immunoassay Test Kits to Delineate Polychlorinated Biphenyls in Soil During a Focused Site Inspection, Ross Incinerator Site, Colman, SD

8. Expedited Characterization and Excavation of Lead in Soil Using X-Ray Fluorescence (XRF), Ross Metals Site, Rossville, TN

9. Expedited Site Characterization of Non-Aqueous Phase Liquids (NAPL) and Petroleum Constituents Using the Site Characterization and Analysis Penetrometer System (SCAPS) and a Mobile Laboratory, McCormick and Baxter Creosoting Company Stockton, CA

10. Characterization, Removal, and Close-out of a Radiological Materials Site in a Single Field Program Using Field-based Gross Gamma Surveys and Gamma Spectrometry Methods

11. Use of Multiple Direct-Push Sensors and a Mobile Laboratory to Delineate Volatile Organic Compounds, Marine Corps Base Camp Pendleton

12. Use of a Triad Strategy and On-site Gas Chromatography/Mass Spectrometry to Monitor the Performance of an In-Situ Electrical Resistance Heating Remediation System in a NAPL Source Area at the Fort Lewis Logistics Center Superfund Site

13. Expedited Site Characterization of Mixed Chlorinated Solvents and Petroleum DNAPL Using Multiple Investigative Techniques in Conjunction with Mobile and Fixed Labs at Fort Lewis Logistics Center Fort Lewis, WA

14. Use of the Membrane Interface Probe (MIP) and Direct Sampling Ion Trap Mass Spectrometer (DSITMS) To Investigate a Potential Source Area at the Vint Hill Farms Station (VHFS) BRAC Site

15. Dynamic Work Strategy Using a Total Vapor Analyzer and Colorimetric Methods for Detection of Chlorinated Solvents and Petroleum Constituents at the Callaway Drum Recycling Site, Auburndale, Florida

16. Characterization of Volatile Organic Compounds (VOC) and Polychlorinated Biphenyls (PCB) Using Immunoassay PCB Test Kits and Field Gas Chromatography (GC) Analysis at the Albert Steel Drum Site, Newark, New Jersey

17. Use of a Hand-held Vapor Monitor to Guide Soil Excavation and Groundwater Treatment at a Site Contaminated with Jet Fuel (Area of Concern 33), Seymour Johnson Air Force Base, Goldsboro, North Carolina

18. Use of an Evolving Conceptual Site Model and Collaborative High Density Sampling Methods to Expedite Site Characterization and Remediation at a Former Landfill, Underground Storage Tank, and Manufactured Gas Plant, Poudre River Site, Fort Collins, CO

19. Rapid Characterization and Management of Decision Uncertainty Using Membrane Interface Probe Technology at Multiple Petroleum Release Sites, South Dakota

20. Consolidation of Multiple Sites for Excavation and Thermal Treatment of PCB Contaminated Soil at Naval Air Station Barbers Point, Oahu, Hawaii