Applying EPA's "Triad Approach" for Accelerated Characterization in New Jersey

by Katherine Linnell, Richard LoCastro, P.G. John Musco & Nicholas De Rose, P.G.

As part of an effort to evaluate innovative approaches for cutting environmental investigation costs at brownfield sites, the EPA's Triad Approach was recently used at two brownfield sites that are part of the Assunpink Creek Greenway Project in Trenton, N.J. The Triad Approach combines systematic planning, dynamic work plan preparation, and real time analysis to achieve an accelerated and more precise characterization of environmental conditions at sites than traditional investigative approaches. The Triad Approach was used at the former Crescent Wire site and a former freight yard site which are part of the Assunpink Creek Greenways Project, an initiative by Trenton to redevelop abandoned properties along the creek into a recreational area and greenway. .

Overview of the Triad Approach

The Triad Approach is a strategy for characterization of environmental conditions at sites that relies upon systematic planning, dynamic work plans, and real time analysis. The primary advantages of the Triad Approach over traditional investigative approaches are reduced uncertainty of environmental conditions, accelerated characterization of environmental effects, and cost savings resulting from the use of lower cost field analytical methodologies (FAMs) and reduced mobilizations over the course of the project. Because of these advantages, the Triad Approach represents a viable and economical strategy for characterization of brownfield sites.

Application of the Triad Approach at Brownfield Sites

The characterization of environmental conditions at brownfield sites typically proceeds with a preliminary assessment to identify potential areas of concern. A comprehensive preliminary assessment often includes a review of the site history, the types of hazardous substances handled and hazardous wastes generated, past and present production processes, chemical storage areas, historical aerial photographs, and the results of previous environmental investigations and remedial actions potentially completed at the site. Initial sampling at areas of concern usually occurs during the site investigation phase to determine if hazardous substances have contaminated site media. The results of the preliminary assessment and site investigation are used to develop the initial CSM.

The Triad Approach is most effectively applied during the remedial investigation phase when target contaminants identified during the site investigation require delineation in the affected media. Because the Triad Approach includes real time analysis, the decision making process is completed in the field thereby minimizing the need for additional mobilizations. These steps allow for the modification of the CSM in the field and modifications in the sampling program, as necessary. Successful application of the Triad Approach results in a detailed understanding of environmental conditions in a compressed time frame, thereby accelerating the schedule for remediation and redevelopment of sites.

Site Background for the Assunpink Creek Brownfields Project

The city of Trenton entered into a Memorandum of Agreement with the N.J. Dept. of Environmental Protection (DEP) to investigate two sites which are part of the Assunpink Creek Greenways Project. The Crescent Wire site is currently owned by the city and was formerly used for the manufacturing of high-tension cables and wires. Operations ceased pre-1995 and the former building was destroyed by fire in 1996. Currently, the site is vacant and is

The Three Legs of the Triad

Systematic Planning

A cornerstone of the Triad Approach is the systematic planning phase in which available site data are reviewed by a multi-disciplinary team, a preliminary Conceptual Site Model (CSM) is formulated, and project objectives are identified to address data gaps in the CSM. Data quality objectives are defined and investigative tools are selected during the systematic planning phase.

Dynamic Work Plan Preparation

A dynamic work plan is prepared to document the investigative objectives and approach for approval by stakeholders and to clearly articulate the goals and decision logic for the field team. An integral component of the Triad Approach is an increased sampling density that reduces uncertainty arising from matrix heterogeneity. This is of particular significance for characterization of soil impacts as spatial variability is often quite high and sample volumes for laboratory analysis are quite low.

Real Time Analysis

Real time analysis of environmental samples using FAMs allows for the review and interpretation of data in the field by an experienced field manager who directs the site characterization program until investigative objectives are met. This is accomplished on a continual basis to avoid time consuming and costly remobilization efforts by applying the decision logic that has been developed in the dynamic work plan. As a result, the site investigation and remedial investigation can be completed with increased accuracy and reduced uncertainty in an accelerated and cost-effective manner.

primarily covered by concrete. The portion of the freight yard site, which was part of this process, is not owned by the city and was historically used as a railroad freight depot. Operations at this site ceased in the mid-1980s. Currently the site includes paved roadways and unpaved areas which are primarily covered by rails.

Preliminary assessments were performed at these sites and several areas of concern were identified at both properties. The specific concerns that were identified for investigation using the Triad Approach included PCB oil effects at the Crescent Wire site. In addition, several areas of concern were identified at the freight yard site including site-wide soil effects across the rail area of the freight yards, an existing above-ground storage tank area, fuel oil spills and areas of distressed vegetation. Based on the identified areas of concern, limited initial sampling was performed at each of the areas to determine the types and levels of contaminants. This information was utilized to support development of the preliminary CSM and to initiate the systematic planning step.

Role of Triad Approach at the Assunpink Creek Site

The Triad Approach was used at the Assunpink Creek site to achieve the goals of the site characterization objectives and to support and define the remediation necessary for the planned re-use of the site into a park and greenway. This approach was used in conjunction with previously collected data to efficiently and cost-effectively move the site towards the remedial decision step. This approach provided generation of a larger amount of data than conventional investigative procedures and therefore reduced uncertainty.

An important consideration of using this approach was to obtain the approval from the N.J. DEP for the use of FAMs to provide a detailed site characterization. The FAMs that were used in the project included immunoassay field test kits for total petroleum hydrocarbon (TPH) and PCB screening, X-ray fluorescence for metals and GC/MS for polycyclic aromatic hydrocarbons (PAHs). These FAMs are non-certified and certified methods which provide accelerated characterization of the media of concern and to identify target compound concentrations. The specific FAMs were selected based upon the preliminary CSM and to achieve identified data quality objectives as well as to satisfy DEP requirements for site investigations and remedial investigations.

Systematic Planning and Dynamic Work Plan Preparation

The systematic planning process involved a careful review of existing environmental data for the sites, the generation of a CSM, and several meetings with stakeholders to identify project objectives and reach a consensus on an investigative approach. The broad purpose of the investigation was to sufficiently characterize environmental effects to support the selection of a remedial approach for the sites.

Once approved by the DEP, the plan was implemented from December 2002 through February 2003. Direct push sampling was used to collect samples. Selected samples were split between the mobile laboratory and a DEP-certified fixed laboratory as a check on the FAM results and to verify the limits of delineation. Several split samples were collected from the boundary to confirm the delineation achieved by FAMS and to satisfy the DEP's requirements for certified data. At each site two split samples were collected in the area of highest concentrations to check the precision of the FAM results.

Triad Investigation Results

The dynamic investigation at the Crescent Wire site accomplished accelerated delineation of the oil and PCB effects in the soil, and the real time evaluation of the collected data determined that they originated from an apparent upgradient off-site source. To characterize site groundwater, three groundwater grab samples were collected from direct push borings using temporary well points within the oil-affected zone. No volatile or semi-volatile organic compounds or PCBs were detected in the samples above the DEP groundwater quality standards. Since the oil and PCB effects were determined to be due to an upgradient off-site source, detailed groundwater delineation was not required.

Delineation of the black soil fill at the freight yard site revealed that it was not restricted to the rail area, but was found on an adjacent parcel of the site extending to the boundary with the Assunpink Creek. Through applying the FAMs using the detailed sampling grid, two unknown hot spots were identified including an area with elevated PAH concentrations and an area of elevated PCB concentrations. The concentrations of PCBs will require a groundwater investigation. A total of 25 confirmatory samples were analyzed at an off-site DEP certified laboratory. These samples verified the delineation achieved by FAMs.

Summary and Conclusions

The investigation indicates that the Triad Approach enabled a more detailed characterization of site conditions in a significantly compressed timeframe. Overall, the use of the Triad Approach at brownfield sites reduces uncertainty and provides greater confidence regarding measuring contaminant effects ,which offers significant advantage over conventional investigation techniques to ensure project success. The completion of the Triad Approach combined site investigation and remedial investigation activities into less than a three-month period. In comparison to using conventional sampling techniques and allowing for at least one document submission and remobilization, an additional six months to a year would have been added to the project.

Using the Triad Approach, sufficient data was generated over the 25 day field investigation to support a remedial selection process for both sites. Only one field mobilization was necessary for each site to reach this stage of site redevelopment. In addition, the use of lower cost FAMs allowed for the collec-

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tion of more samples than in a typical investigation, which reduced the uncertainty of site characterization.

The approach accomplished confirmation of significant off-site effects to the Crescent Wire site that resulted in eliminating the responsibility for on-site remediation of soil and ground water by the city of Trenton. Complete characterization of the freight yard site was accomplished with greater confidence than would have been accomplished by a conventional sampling approach. This included eliminating the concern about ground water effects and the identification of a PCB "hot spot" that likely would have been missed using a conventional sampling approach.

A remedial alternative analysis is currently being conducted for these two sites.

Katherine Linnell, Richard LoCastro, P.G. John Musco & Nicholas De Rose, P.G. are employed by Langan Engineering and Environmental Services, Inc., Doylestown, Pennsylvania. All field analytical methods provided by S2C2 Inc. of Warren, N.J.

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Suggestions

an objective, it is not always appropriate or necessary to protect human health and the environment. Other relevant considerations—such as current and reasonably anticipated future use of the land and groundwater, the feasibility of groundwater cleanup to that extent, the availability of effective institutional controls, and state groundwater protection cleanup policies and practices—should also be taken into account when determining the nature and extent of groundwater cleanup. The EPA should also work with states to encourage the development of groundwater classification systems and/or groundwater cleanup policies that are based, at least in part, on the current and reasonably anticipated future use of groundwater.

Adding a "construction complete" category to the RCRA completion guidance would enhance the commendable job the EPA did in responding to public comment on earlier drafts of the RCRA completion guidance to ensure that the "complete with controls" category of RCRA would be useful in ensuring the evaluation of facilities where the EPA considers corrective measures that have been implemented with engineered or institutional controls to be final remedies subject only to ongoing operation and maintenance .

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But the EPA needs to change the RCRA Completion Guidance to add a "construction complete" category comparable to that established under the Agency's CERCLA program as well as creating a functional website informing interested parties of those facilities that have received "completeness" determinations on a nationwide basis. There is also a need to encourage EPA Regions to follow the lead of Region VI in establishing mechanisms like that Region's "certificate of fitness for reuse," and it should continue the efforts to find suitable mechanisms short of RCRA permits and orders that will ensure completion of corrective measures and ongoing O&M

Refining the "one cleanup program" agenda to improve the effectiveness of the cleanup process in promoting redevelopment of contaminated sites could enhance the goal of encouraging redevelopment and reuse of contaminated properties. Among other things, the EPA has recognized the importance of using "successful alternative [cleanup] approaches" to promote "more consistent and effective cleanups"; providing readily accessible information to the public on the nature and status of cleanup efforts at sites, and developing better "performance measures" to gauge the "overall effectiveness and benefit of the nation's combined cleanup efforts." In addition, in support of its objective of promoting more consistent and effective cleanups, EPA has committed to the formation of cross-program task forces that will analyze such critical cleanup issues as remediation of contaminated groundwater and "long term site stewardship" through financial assurance and presumably institutional controls.

Similarly the EPA's Land Revitalization Agenda represents a noteworthy effort on EPA's part to identify means by which