Case Study for the Use of a Decision Support Tool: Using SCRIBE to Manage Data During a Triad Investigation, Milltown Redevelopment Site, Milltown, New Jersey

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FOREWORD

This case study is one in a series designed to provide information on use of decision support tools that support the use of data, models, and structured decision processes in decision-making. These case studies include reports on selected tools that have been used to support activities such as site assessment and remediation, data management and visualization, and optimization. They are prepared to offer operational experience and to further disseminate information to project managers, site owners, environmental consultants, and others who wish to screen decision support tools and benefit from their previous use at sites.

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1.0 SITE BACKGROUND

The Milltown Redevelopment site, otherwise known as the Former Michelin Tire Company site, is located in the western section of Milltown, New Jersey. It occupies one of the oldest parts of the town and is bordered by residential and commercial districts along Ford Avenue to the northwest and Mill Pond to the southwest. More than 50 percent of the 22-acre site is covered with warehouses and industrial buildings. Industrial use of the site began with a rubber manufacturing plant in the late 1800s and has been succeeded by numerous other industries over its history. The eastern portion of the site was the first developed. All of the buildings on this side of the parcel are abandoned, and many are in a state of advanced disrepair and are dangerous to enter. The western portion of the site was developed more recently, and some buildings remain occupied.

The Middlesex County Improvement Authority (MCIA) began planning for the 22-acre Milltown Redevelopment site in 2001. In 2002, a preliminary assessment was conducted on the site to assemble background information and to identify potential areas of concern (AOCs), as part of developing a preliminary conceptual site model (CSM). The Milltown - Ford Avenue Redevelopment Agency began assisting with the redevelopment process in 2003.

Also in 2003, the MCIA was awarded a $350,000 Brownfields Assessment Grant by the U.S. Environmental Protection Agency (EPA) to conduct a site investigation (SI) that would help quantify suspected contaminants. As a result, an SI and remedial investigation (RI) were planned to expand on the CSM and to identify site-specific contaminants of concern (Najarian and others 2004). EPA also provided support for implementing the Triad approach through its Brownfields and Land Revitalization Technology Support Center (BTSC). The Triad approach is an integrated method to manage decision uncertainty at hazardous waste sites. The Triad approach draws on advancing science, technology and practitioner experience to perfect strategies for making site work more defensible, resource-effective, and more responsive to stakeholder concerns (Crumbling and others, 2004). The term “Triad” refers to the three core elements of the approach: systematic planning, dynamic work strategies, and real-time measurement technologies, including field-based analyses.

In addition, the MCIA facilitated an application for New Jersey Department of Environmental Protection (NJDEP) Hazardous Discharge Site Remediation funds to conduct further environmental assessment. This application led to an award of more than $500,000 to the Milltown Redevelopment Agency. At the same time, the Milltown Redevelopment Agency negotiated an agreement with a redeveloper for the area

that involved more than 300 age-restricted housing units, together with commercial and open space. A large and diverse stakeholders' group was organized to plan, conduct, and oversee the Milltown Redevelopment project, as shown below in Table 1.

TABLE 1

SUMMARY OF STAKEHOLDERS FOR MILLTOWN REDEVELOPMENT SITE

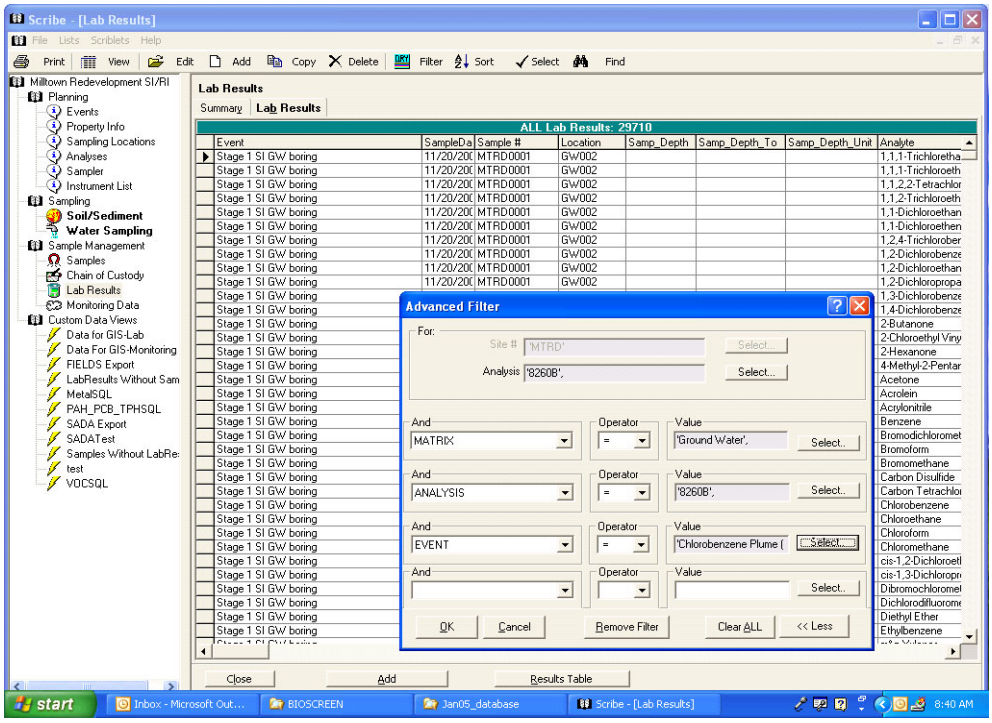
Stakeholder	Role
Middlesex County Improvement Authority	Received Brownfields Assessment Grant
Milltown - Ford Avenue Redevelopment Agency	Received funding from NJDEP to conduct further environmental assessment, contracted with Najarian, and negotiated an agreement with a redeveloper for the area for residential, commercial, and open space
New Jersey Department of Environmental Protection	Provided regulatory oversight
EPA Region 2	Provided collaborative oversight
Najarian Associates	Provided project and data management; served as core technical team during site investigation
S2C2 Inc.	Served as core technical team during site investigation
New Jersey Institute of Technology	Provided technical support on planning for use of the Triad approach at the site
Argonne National Laboratory	Provided technical support on planning for use of the Triad approach at the site
EPA Brownfields and Land Revitalization Technology Support Center	Provided technical support on planning for use of the Triad approach at the site
EPA Environmental Response Team	Provided support on use of Scribe and Scriblets (decision support tools)

2.0 USE OF DECISION SUPPORT TOOLS

Scribe (http://www.ertsupport.org/scribe_home.htm) is a software tool developed by the EPA's Environmental Response Team (ERT) to assist in managing environmental data, primarily sampling, observational, and monitoring field data. Scribe can import electronic data, including analytical laboratory results in electronic data deliverable (EDD) format and sampling location data such as global positioning system (GPS) and provides a flexible user interface to manage, query, and view this information . It can also be used to print sample labels and chain-of-custodies. When it is integrated with a software extension called Scriblets, it can be used to capture and import sampling and monitoring data that are collected on handheld portable data assistants (PDAs) during field work. Figure 1 is a screen shot of Scribe, showing its tool for filtering data.

FIGURE 1

SCRIBE DATABASE AND DATA FILTER TOOL – EXAMPLE OF USE AT MILLTOWN



The project team entered known information (lab analyses, locations, media) into Scribe at the beginning of the project. This information was transferred to Scriblets, which ws loaded on PDAs, decreasing transcription errors and the time spent entering data. Scriblets also allows the user to set up a sample number mask (for example, MTRD####) and most data (such as container, medium and sampler) will carry over from sample to sample (from sample number MTRD0001 to sample number MTRD0002, for instance).

Location data were collected using a GPS, while sampling data were recorded on a handheld PDA using the Scriblets software. The field team collected samples for a large list of chemicals of concern (COCs) including: metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic compounds (PAHs), polychlorinated biphenyls (PCBs), pesticides, and total petroleum hydrocarbons (TPH). Sampling teams consisted of two members: one to collect the sample and one to log the result into Scriblets on a PDA in real time (Figure 2). The PDA was routinely "synched" to the field computer. In other words, the PDA was connected to the computer with a USB cable and after review, the data were transferred directly into Scribe using built-in functionality.

FIGURE 2

TECHNICIAN ENTERING SAMPLE DATA TO PDA

All sample locations were subsequently surveyed with a GPS unit (Ashtech 2-Extreme, as shown in Figure 3). A TopCon Robotic Total Station was used to extend the GPS capabilities to areas where the unit was blocked from receiving satellite data. (The robotic unit measures the distance from the GPS unit and has a level to measure the elevation difference.) The surveyor was able to record all of the location data on the GPS software and download them into Scribe at the end of the day in the same manner as with the PDAs.

Using this process, the field team was able to sample over 400 locations in a time period of slightly more than 5 weeks. The field team collected more than 130 groundwater samples and 600 soil samples, generating over 26,000 analytical results that had to be loaded into the database and undergo quality control (QC) checking in a short period of time (Another 3,200 sample results from the Stage 1 investigation were also loaded to the Scribe database.). A detailed breakdown of the analytical results generated during Stage 2 and loaded into the Scribe database is provided in Table 2.

FIGURE 3

SURVEYOR COLLECTING LOCATION DATA WITH GPS

TABLE 2

SUMMARY OF SAMPLES COLLECTED AND ENTERED TO SCRIBE

Matrix	Analytical Group(s)	Analytical Methods	Number of Records
Groundwater	VOCs	8260B, 8260B Mod	6,834
Groundwater	SVOCs	8270C, 8270C Mod	240
Groundwater	Metals	6020, 7471A	230
Sediment	SVOCs	8270C, 8270C Mod	977
Sediment	Metals	6020, 7471A, 6200M	1,004
Sediment	Pesticide/PCBs	8081A, 8082	122
Soil	VOCs	8260B	5,308
Soil	SVOCs	8270C, 8270C Mod	5,618
Soil	Metals	6020, 7471A, 6200M	6,780
Soil	Pesticide/PCBs	8081A, 8082	1,153
Soil	Total PAHs, TPH	SiteLab	536
Surface Water	VOCs	8260B	55
Surface Water	SVOCs	8270C, 8270C Mod	64
Surface Water	Metals	6020, 7471A, 6200M	92
Surface Water	Pesticide / PCBs	8082	20
Miscellaneous Sample Records (other matrices and analyses)			2,625
Total			30,755

Notes:

Mod = modified
PAH = Polyaromatic hydrocarbons
PCB = Polychlorinated biphenyls
SVOC = Semivolatile organic compounds
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compounds

The benefits of streamlined data acquisition and processing using Scribe were evident during the dynamic investigation of a chlorobenzene plume. The Stage 1 investigation in November 2003 found a detection of chlorobenzene in a groundwater sample collected at the northern end of the site. In response, this area was identified as the chlorobenzene plume (CP) area and a focused sampling plan was developed for Stage 2 of the investigation. During a site walk immediately preceding the Stage 2 investigation, the NJDEP case manager noticed a vat under a formerly-used loading dock that had been obscured by heavy brush. A sample from the vat verified the presence of chlorobenzene. Even if the vat had not been discovered at the outset of the Stage 2 investigation, the dynamic work strategy would have lead to its discovery as the chlorobenzene concentrations in groundwater increased steadily as distance to the source was shortened. Using Scribe as an iterative data storage and analysis tool, the plume was delineated in approximately 4 days after 63 groundwater and 28 soil samples were collected from 46 sample locations.

After each round of sampling, the data were imported to Scribe, queried, and exported to AutoCAD through a custom program written by Najarian Associates. Maps and sample event status information were posted to a project website, to which all stakeholders had access. The entire project team (including stakeholders who were not present at the site) was able to review tables and maps that summarized the teams' updated understanding of the extent of the plume (see example in Figure 4) at the end of each day and then provide input for the next day's sampling. The dynamic work strategy anticipated the need for rapid delineation and provided decision logic diagrams in the work plan to facilitate this process, even though it did not initially specify the exact locations where the samples would be collected. Because Scribe provided quick turn-around of preliminary sample results, optimal adaptive sampling locations were identified shortly after previously-collected samples were analyzed. In this manner, the plume delineation was expedited and the CSM was developed to explain the likely source of the plume and the mechanisms that contributed to its spread.

The information from the investigation was used to develop and communicate the CSM of environmental conditions at the site to the residents of Milltown and show them how the redevelopment will promote the remediation. The engineer for the developer is using the data to develop a remedial cost estimate. The Redevelopment Agency has hired an appraiser to value the property and the remediation estimate will be considered during their efforts to determine the value of the property. The final report will be used as a basis for discussions with NJDEP about the type of remediation that will be necessary for various portions of the property (the redevelopment is planned to include residential, commercial and recreational uses).

Figure 5 below shows another option for displaying the data. The figure below was developed using Spatial Analysis and Decision Assistance (SADA) software package, developed by the University of Tennessee, to interpolate the chlorobenzene data (using the inverse distance weighting algorithm). The figure depicts chlorobenzene concentrations for the 5.0 to 10.0-foot interval. SADA can provide graphical support for field teams shortly after data are acquired with Scriblets and stored in Scribe. The user can customize an export spreadsheet format that allows seamless data transfer out of Scribe and into SADA for interpolation and display. (SADA is described in the Marino Brothers Scrapyard case study located elsewhere at this website.)

FIGURE 4

EXAMPLE OF MAP OF CHEMICALS OF CONCERN IN THE CHLOROBENZENE PLUME AREA

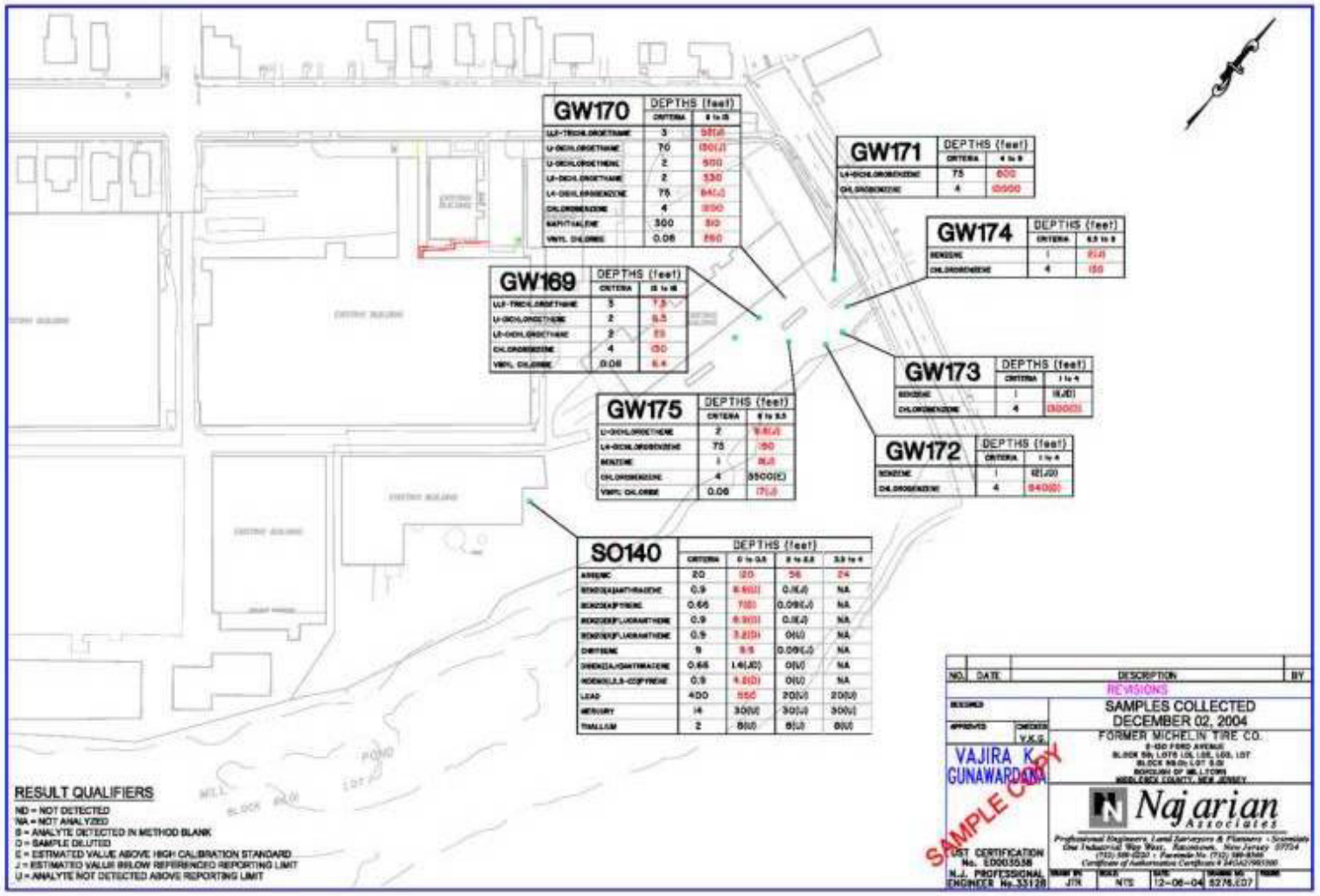
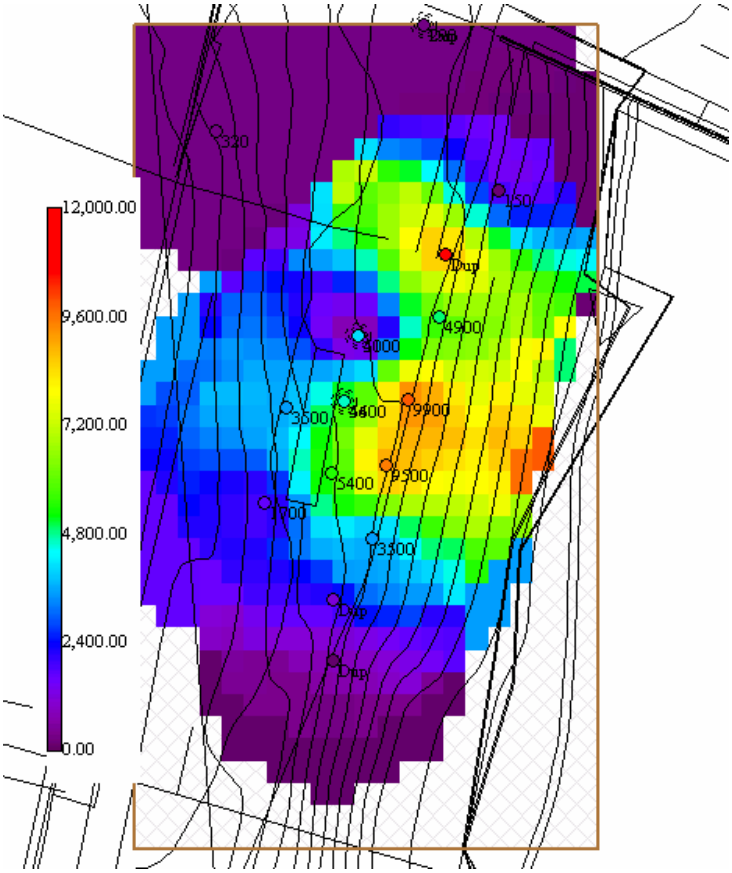


FIGURE 5

CHLOROBENZENE CONCENTRATION MAP FOR THE CHLOROBENZENE PLUME AREA, 5.0 TO 10.0 FEET
(all values are in micrograms per liter [µg/l])



Note: The data points denoted by "Dup" indicate duplicate sample results at the location. The values at the red-highlighted point are both 12,000 µg/l, which appear in a mouse-activated rollover window when the display is active in SADA

3.0 LESSONS LEARNED

The data management team at the Milltown site described Scribe as the "cornerstone" of its data management and communication strategy for this Triad project. In the opinion of this team, Scribe significantly reduced the lag time from field sample collection, to on-site laboratory analysis, to generation of report-quality maps. Just as important, the all-electronic data pathway made possible by integrating EDDs, GPS, and Scriblets with Scribe eliminated transcription errors, providing the project team with increased confidence in the quality of the data. Scribe was used to generate sample labels in the field, much like Forms II Lite; however, Scribe was also used as a primary decision support tool. Scribe's Microsoft Access shell provides querying and sorting functions that enabled the project team to answer questions about analytical results and sampling events immediately after the data were entered into Scribe.

Scribe, however, is not a visualization tool. As a result, the data management team developed a customized program that exported data from Scribe to AutoCAD to produce report-quality maps. The maps were then posted to a project website so that all stakeholders had access to the graphics as soon as they were developed, allowing them to track the progress of the investigation in real time. Scribe can also be configured to export data to a variety of visualization programs included with the DST matrix, including the SADA and the FIeld EnvironmentaL Decision Support (FIELDS) system.

Scribe was integral to implementing all three elements of the Triad at the Milltown Redevelopment site. Data was loaded to Scribe throughout the day as the site investigation progressed; the data were available for sorting, querying and exporting to an AutoCAD program that was used to create plots of the most recent sample results. These plots were shared with the project stakeholders in the field and on the web site (for stakeholders who could not be present in the field). Thus, information was shared with the entire team almost immediately, an important aspect of systematic planning. The rapid turn-around of data from collection to presentation facilitated the dynamic work planning process, particularly during the delineation of the chlorobenzene plume. Scriblets allowed sample results from real-time analytical methods to be loaded to the database several times during the day. All three Triad elements were instrumental in making this project a Triad success story.

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Scribe Website: *http://www.ertsupport.org/scribe_home.htm*

Milltown Website: *www.epaosc.org/milltown*