RAPID SITE ASSESSMENT APPLIED TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S DRYCLEANING SOLVENT CLEANUP PROGRAM

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ABSTRACT

Applying the rapid site assessment approach to characterize soil and groundwater contamination at drycleaning facilities and drycleaning wholesale supplier sites is drastically reducing the time and costs associated with site assessments. These rapid site assessments, conducted under the Florida Department of Environmental Protection's (FDEP's) Drycleaning Solvent Cleanup Program (DSCP), are attaining the FDEP DSCP goal: to reduce the time spent "studying" sites and move them to remediation within one year.

Specific rapid assessment tools to achieve the FDEP DSCP goal are both administrative, such as flexibility in scoping work and costing (e.g., unit pricing), and technical, including streamlined work plans and innovative sampling and analytical methods. Direct-push ("DP") technologies are used to characterize site lithology, geology, and hydrogeology and to collect soil and groundwater samples (more than 500 samples at eight sites in Jacksonville, Florida). On-site mobile laboratories provide the on-site hydrogeologist with analytical results in less than 30 minutes.

By obtaining "real-time" data, senior hydrogeologists are able to make decisions that facilitate completion of site assessments during a minimum number of fieldwork phases. Real-time data and rapid decisions made in the field enable performance of necessary work which is beyond the original scope of work. Rapid assessment techniques allowed field teams to characterize eight drycleaning and wholesale facilities within a five-week period. Using DP technology also greatly reduced the production of investigation-derived waste and associated disposal costs.

The rapid site assessment approach, which expedites the investigation phase and frees more funds for actual site remediation, can be applied to Superfund sites. Resources allocated for Superfund sites or similar State-funded programs can be directed to actual site remediation, rather than into conventional, lengthy, and costly Remedial Investigation/Feasibility Study processes.

1.0 INTRODUCTION

1.1 Florida's Drycleaning Solvent Cleanup Program (DSCP)

In 1994, the Florida Legislature established a state-funded program to remediate properties contaminated as a result of the operations of a drycleaning facility or drycleaning wholesale supply facility (Chapter 376.3078, Florida Statutes). The Drycleaning Solvent Cleanup Program (DSCP) is administered by the Florida Department of Environmental Protection (FDEP). The statute was sponsored by the drycleaning industry to address environmental, economic, and liability issues resulting from drycleaning solvent contamination. The DSCP limits the liability of the owner, operator, and real property owner of drycleaning or wholesale supply facilities for remediating drycleaning solvent contamination if these parties have complied with and met the conditions stated in the statute.

A fund has been established to pay for costs related to the assessment and remediation of such properties. Revenue for the fund is generated by a gross receipts sales tax, a tax on tetrachloroethene (PCE) sold to or imported by a drycleaning facility, annual registration fees, and structured deductable payments. The Drycleaning Solvent Cleanup Rule (62-781, Florida Administrative Code, effective March 13, 1996) sets forth the requirements for application to the DSCP and provides the forms to apply to the DSCP and to document contamination. The FDEP began accepting applications to the DSCP on the effective

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date of the DSCP, and to date has found 706 facilities eligible for the DSCP.

The DSCP identifies the criteria that determine whether a site is eligible. The FDEP reviews the DSCP application and determines whether a site has met the requirements. A score is developed for the site by the FDEP in accordance with the statutorily prescribed scoring system. The scoring system considers various factors including evidence of contamination at the site and the potential risks to human health and the environment. Of the 706 sites that have been determined eligible to date, 82 sites have been assigned to 10 state contractors for assessment and remediation, as necessary. As drycleaning-solvent sites are typically more complex than petroleum sites and often require greater resources for assessment and remediation, the FDEP needed to develop more efficient and cost-effective methods for assessing relative risks associated with each site, for minimizing resources used in the assessment, and to focus the DSCP's limited funding on actual site remediation.

For more general DSCP information, related documents and other program information are available through the FDEP Fax-On-Demand System. Copies of the registration forms, Rule 62-781 and forms, a DSCP status update, and other information can be obtained by telefacsimile by calling (800) 789-4502. The system is periodically updated as additional information becomes available. Information can also be retrieved from the Internet at: **http://www.dep.state.fl.us/waste/programs/dryclean/index.htm**

1.2 Objectives of the FDEP's Drycleaning Solvent Cleanup Program (DSCP)

The FDEP has selected 10 contractors (state funded) to assess and remediate eligible sites under the DSCP and other state-funded hazardous waste sites. Because of the limited funding available, the FDEP has developed numerous methods to cost-effectively address drycleaning-solvent sites. During the contractor selection process, the FDEP required each firm to present an overview of how they would administer a drycleaning solvent cleanup program, reduce costs, and meet the FDEP goal of moving from assessment to remediation within one year. The FDEP compiled the contractors' best ideas along with its own to establish the DSCP, a program that quickly and cost effectively identifies sites that pose the greatest potential risks to human health and the environment.

The FDEP's objectives are to rapidly assess DSCP-eligible drycleaning-solvent sites, perform risk-based corrective action (RBCA) evaluations, and then decide the appropriate future action(s) for each site. To meet these objectives, the FDEP developed guidelines that include administrative and technical methods and considerations. The intent of the guidelines is to facilitate moving sites through assessment to remediation within one year of the site's assignment to one of the 10 state-funded contractors. These guidelines include: 1) assigning sites within one or common geographical areas to the same contractor; 2) establishing well negotiated labor, equipment, and laboratory rates; 3) developing streamlined and flexible work plans and cost estimates; 4) completing site assessments in a minimum number of phases using rapid assessment techniques and maintaining open communication during assessment activities; 5) establishing standard database formats for all data that are generated and submitted to the FDEP; and 6) establishing streamlined and standard contamination assessment reports (CARs) and remedial action plans (RAPs).

2.0 ADMINISTRATIVE METHODS AND CONSIDERATIONS

Conducting rapid assessments for the FDEP DSCP was facilitated by the preparation of streamlined work plans that were concise and flexible in scope and associated costs. This was extremely important to the rapid assessment approach because the main goal was to complete the assessments in a minimum number of fieldwork phases. Work plans and cost estimates were prepared so that, during the initial phase of fieldwork, changes necessitated by conditions in the field could be agreed upon between the project and contract managers and the additional work conducted without schedule delays.

2.1 Streamlined Work Plans

Preparing streamlined work plans required initial site visits and meetings with FDEP's contract managers to develop scopes of work for each site. During these meetings and the development of the work plans, specific sampling locations, resources needed for conducting the work, and key potential obstacles to the assessment (e.g., property access issues) were identified.

Typical streamlined work plans consisted of a one-page site background/description, a two-page scope of work, and three figures showing site location, site features, and proposed sampling locations. The document format minimized preparation time and associated costs and enabled reviewers of the work plans to quickly understand the background of each site and the proposed scope of work, thus facilitating the approval process.

2.2 Unit Pricing Structure

Developing a unit cost pricing structure using established rates (either contract rates or actual price quotes from subcontractors) enabled project managers to quickly develop cost estimates to accompany the scopes of work. Contract rates included labor and per diem; rates for subcontractors (e.g., direct-push, mobile laboratory, and fixed-base laboratory); and equipment rates. Many of these were structured in the work plans as unit price daily rates. Unit pricing allowed quicker review and approval time for conducting work because rates were known and agreed upon prior to the preparation of the work plans.

Furthermore, unit pricing facilitated preparing change orders in the field for additional sampling points, if needed. As the main goal of rapid assessment was to complete the assessment with a minimum number of mobilizations, it was important that changes in the scopes of work were easily defined, estimated, and approved. Historically, change orders for additional fieldwork might have indicated that a contractor project manager had not scoped the work appropriately. For rapid assessment, the submittal of change orders was expected. It is important to remember that site assessments were conducted because the extent of contamination was *not* known; therefore, changes in the scopes of work and associated change orders were expected. Communication between the project and contract managers during time-critical phases of fieldwork, and the completion of the required paper work facilitated the efficient performance of additional fieldwork, thereby enabling completion of the rapid assessments in a minimum number of fieldwork phases.

3.0 TECHNICAL METHODS AND CONSIDERATIONS

3.1 Rapid Assessment Methods - Planning and Scheduling

Completing the eight Jacksonville rapid site assessments required thorough planning and careful scheduling. Thorough planning minimized potentially iterative field mobilizations, such as might have resulted from neighboring property access problems.

The FDEP created a brief, standard site access form that adequately addressed most property and neighboring property access issues. During work plan development and prior to mobilization, neighboring property parcels were identified, property owners were contacted, and property access permission was acquired.

Thoughtful planning also minimized potential down time related to unknown underground utility locations, drycleaning operations, overhead powerlines, and traffic, as well as other existing site contamination, such as petroleum constituents potentially associated with neighboring gasoline stations. Acquiring background information on hydrogeology and potential contaminant sources during the work plan development was critical to the rapid assessments. This background information enabled specific targeting of horizontal and vertical sampling locations. Collecting the relevant background information involved researching lithology, geology, and hydrogeology in each site area to evaluate routes of potential migration and to identify confining/-semiconfining units or other features such as fill, peat, and/or significant geological units. In-depth interviews with drycleaning facility representatives were conducted to identify and target potential source areas, such as floor drains, sewer lines, spills, leaks, or used filter storage areas, for assessment.

Careful scheduling minimized the number of field mobilizations and realized cost savings by using subcontractors, such as DP contractors, mobile laboratories, and drillers, on multiple site assessments in a common geographical area. For the DSCP, detailed schedules for the assessment phase of work were developed using Microsoft® Project© software. These schedules addressed the mobilization for multiple sites by utilizing teams of DP and mobile laboratories.

At the first scheduled site assessment during rapid assessment, DP drilling and sampling were conducted, followed by immediate sample analysis by an on-site mobile laboratory. Subsequently to completing the work at the first site, the DP unit and mobile laboratory moved to the second site (in the same geographical area) without requiring additional mobilization. The drilling and installation of monitoring wells was then initiated on the first site, and so on. The DP contractor and mobile laboratory were available to mobilize to multiple sites if additional assessment was deemed necessary during the initial assessment phase. Careful scheduling also optimized other labor, equipment, and subcontracted services, such as sharing sampling technicians, sampling equipment, and surveying services among sites.

3.2 Rapid Assessment Tools

Rapid assessment tools have been available for several years, but their use for Superfund and other State-directed assessments has been limited. This limited use may have resulted because regulatory agencies and regulatory guidance documents have considered the use of such tools more a "screening" method than a sampling method which yields defensible and valid data. Only recently have these tools gained recognition for enabling the collection of data that is readily acceptable, and as initial tools used to guide

more permanent sampling locations such as the installation of permanent monitoring wells.

3.2.1 Direct Push Technology

DP technology has been available for years, but for Florida's DSCP, it appears to be the assessment tool of choice. DP utilizes hydraulics to drive a small diameter rod into the subsurface to collect both soil and groundwater samples. There are a great number and variety of probes, many of which work on similar principles, and have a variety of applications. The probes are versatile, can get to "hard to reach" places, and can obtain soil and groundwater samples more quickly than conventional drilling techniques. DP has the capability to collect excellent continuous and undisturbed core samples for lithologic identification with a better recovery than conventional split-spoons from drilling rigs.

The depths of sampling range from several feet below ground surface (bgs) to depths exceeding 100 feet bgs. Costs for conducting DP typically ranges between $1,000 to $1,500 per day, and the rapid growth in available contractors using DP has increased the competition and reduced the cost of conducting DP assessment.

Soil and groundwater data obtained using DP is typically used to locate permanent monitoring wells. It also appears that the environmental industry is moving toward acceptance of DP-generated data and a concomitant reduction in the number of required permanent wells. Additionally, microwells, which can yield representative data, can be installed using DP in less time and at lower cost than to install conventional monitoring wells. Microwell screens are pre-packed so that minimal formation disturbance occurs during installation. The validity of the analytical data obtained from DP points is further supported by the favorable comparison between chemical concentrations detected in groundwater at DP points with concentrations detected in monitoring wells installed near the DP points.

DP technology significantly reduces the amount of solid and liquid investigation-derived waste (IDW) generated during site assessments. Because formation materials are pushed to the side and not retrieved from the subsurface during DP, there is much less IDW to dispose of upon completion of the assessment. Historically, the costs for handling and disposing of IDW from site assessments ranged up to more than 30 percent of the assessment costs. Using DP technology combined with permanent monitoring wells for the DSCP, costs associated with IDW ranged from 5 to 10 percent of the assessment costs, representing a significant reduction in costs and project management time.

3.2.2 Mobile Laboratories

Using a mobile laboratory in the field is a key ingredient of rapidly and successfully assessing a site. Historically, the cost for an on-site mobile laboratory prohibited the use of on-site mobile laboratories for most site assessments (costs typically ranged from $1,000 per day to $1,500 per day). In addition, few mobile laboratories had acquired state certification for running standard U.S. Environmental Protection Agency (U.S. EPA) analytical methods in the field. Since the inception of the Florida DSCP, numerous mobile laboratory companies have obtained or are in the process of obtaining certification for U.S. EPA analytical methods 8010 and 8020 from the FDEP Quality Assurance Section. Such certification has facilitated the use of mobile laboratories, thus enabling receipt of valid data *while in the field* for chlorinated and nonchlorinated volatile organic compounds (VOCs) in soil and groundwater. Although the cost of an on-site mobile laboratory may appear prohibitive, the benefit of obtaining real-time soil and groundwater data *in the field* outweighs the lower cost of using traditional fixed-base laboratories during the initial phase of an assessment. As more companies move into the mobile laboratory market and obtain state certification, competition will most likely drive down the cost of mobile laboratories.

The advantages of using an on-site mobile laboratory include optimizing information output for plume and source area delineation, thereby guiding the placement of additional soil and groundwater sampling points and permanent monitoring wells for confirmatory and long-term sampling. The mobile laboratory is key to enabling the definition of the extent of contamination during a minimum number of mobilizations. Most mobile laboratories can obtain the nondetect line for benzene, toluene, ethylbenzene, and xylenes (BTEX), PCE, and PCE breakdown products [detection limits range from 1 to 5 parts per billion (ppb)].

3.2.3 Real-Time Data Interpretation and Decision Making

DP technology and mobile laboratories have been available for many years. What is unique today is that their combined utilization makes rapid assessment successful through the evaluation and interpretation of real-time data while in the field. The objective of most assessments, which is defining the horizontal and vertical extents of contamination, is met in a minimum number of fieldwork phases. Using experienced hydrogeologists and scientists *in the field* to evaluate real-time soil and groundwater data from DP sampling points is key to the decision-making process during a rapid assessment. Timely communication of field data to FDEP project managers facilitated in-field

decisions regarding expanded scopes of work, if necessary, and further streamlined the assessment phase.

4.0 RAPID ASSESSMENTS AT EIGHT FDEP DRYCLEANING-SOLVENT SITES

In November 1996, Levine·Fricke·Recon Inc. (LFR) was one of 10 firms contracted under the FDEP DSCP to conduct contamination assessments at drycleaning and drycleaning wholesale facilities in Florida. LFR was initially assigned 12 sites, eight of which were located in Jacksonville, Florida. Initial site visits and interviews with the drycleaning facility owners/operators were conducted, and scopes of work and cost estimates were prepared using the streamlined work plan and unit pricing approach discussed above. Site access permission was obtained by the project managers prior to mobilization. Detailed schedules were prepared using Microsoft® Project©.

For the eight sites in Jacksonville, LFR's scheduling approach utilized four teams of experienced hydrogeologists and scientists. The schedule was designed so that two of the teams utilized the same DP/drilling contractor and mobile laboratory; once the initial DP work was performed at a site, the DP and mobile laboratory subcontractors moved on to the next site, while drilling commenced at the first site.

In January 1997, four teams commenced work, using two teams of DP/drilling contractors and State-certified mobile laboratories. Within the next 10 weeks, rapid assessments were completed at all eight sites. More than 500 soil and groundwater samples were collected and analyzed; an average of approximately 72 soil and groundwater sampling points were advanced at each site.

The settings for most of the drycleaning-solvent sites were operating drycleaning facilities located in populated neighborhoods, strip malls, and/or shopping centers. The eight sites were highly ranked in the FDEP's DSCP, as most were within 0.5 mile to 1 mile of public drinking water supply wells; therefore, these sites were among the first to be assessed. Most of these assessments occurred at active facilities; therefore, disturbance of operations was minimized.

A typical scope of work for the eight rapid assessments included an initial two to five days of DP and mobile laboratory activities (with anywhere from 8 to 20 sampling points), followed by the installation of three to seven permanent monitoring wells. The number and placement of the monitoring wells were based on the DP/mobile laboratory soil and groundwater data.

The first fieldwork task was to evaluate site-specific lithology by collecting continuous macro cores across the site. This task identified potential confining or semiconfining units that could potentially have been compromised during the invasive phase of the investigation. Soil and groundwater sampling and analysis then commenced with the DP and mobile laboratory, using an "outside-in" approach. As data were collected and analyzed, the on-site scientists tabulated and evaluated the data and created summary tables and figures to quickly help illustrate and interpret the results.

During and after evaluating and interpreting the initial data, the field hydrogeologist continually communicated the data and recommendations to the FDEP contract manager. The field hydrogeologist received timely approval for additional sampling points beyond the original scope of work, if applicable, to completely define the horizontal and vertical extents of contamination. Vertical sampling intervals using DP typically ranged from 10 to 15 feet bgs; horizontal sampling intervals typically ranged from 10 to 50 feet. For seven of the eight sites, the scopes of work were expanded 50 percent to more than 100 percent over the original scope of work. Table 1 presents details by site illustrating the magnitude of the Jacksonville field effort.

Table 1: Total numbers of DP sampling points, mobile laboratory samples, temporary and permanent monitoring wells installed, and fieldwork days for each of the eight Jacksonville site assessments

Site Name	DP Sampling Points	Mobile Laboratory Samples	Monitoring Wells Installed	Total Number of Fieldwork Days
Miller	96	119	5	17
Butler	87	114	3	8
Professional	124	161	9	20
Herman Jackson	73	96	5	10
Sages	52	78	5	7
Denim & Lace	23	25	3	3
Walgreen	46	54	3	7
Koretizing	50	56	4	7
TOTAL	574	634	37	79
AVERAGE/SITE	72	79	4.5	10

The results of the initial soil and groundwater data showed that contamination at all but one site (Denim & Lace) was more extensive than anticipated. Most of the drycleaning facilities were located on small tracts of land. The assessment results indicated long, narrow groundwater plumes of PCE and its breakdown products had migrated off site. In addition, five of the eight sites exhibited PCE concentrations suggesting the presence of dense nonaqueous-phase liquids (DNAPLs). Because of the extensive contamination, most of the scopes of work increased to define the extent of contamination (with a minimum number of fieldwork phases). As unit prices were already established and agreed upon, it was a simple matter of agreeing to the number of additional sampling points and time to complete the additional work. After evaluation of the DP data, monitoring wells were installed, developed, and sampled, and the groundwater samples were sent to fixed-base laboratories. Fixed-base laboratory values for groundwater concentrations in monitoring wells compared favorably with concentrations detected by the mobile laboratory analyzing groundwater samples collected at the same locations using DP. It should be noted that the quality of the data from the mobile laboratory was within normal ranges and considered valid data. Figures 1 and 2 illustrate data from two of the eight drycleaning-solvent sites assessed in Jacksonville, Florida.

Upon completion of the field assessments, detailed property surveys were conducted to locate sampling points and to determine top of casing elevations for monitoring wells.

The volume of IDW was minimized through the use of DP. Furthermore, prior to demobilizing the mobile laboratory, both solid and liquid IDW were analyzed, thereby reducing the cost of analysis and disposal of the IDW. An evaluation of the treatment cost for liquid IDW also was performed.

Subsequent to the rapid assessments, a mobile treatment unit, consisting of a tray air stripper and carbon unit, was used at the sites to cost effectively treat the liquid IDW. Solid IDW was characterized, manifested, and sent off site for disposal.

5.0 DATA MANAGEMENT AND REPORTING

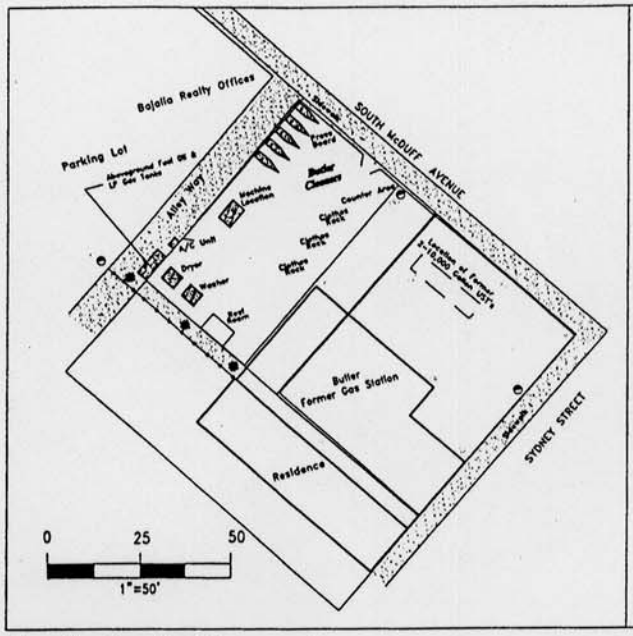
Data collected during the assessments was subsequently inputted into a Microsoft® Access© database. The data included soil and groundwater chemical concentrations, monitoring well construction information, sampling field parameters, water levels, and survey data. Data were electronically uploaded into the database thus minimizing the time for the manipulation of the data and minimizing potential human error associated with manually transposing data into the database. Data were obtained from both the mobile and fixed-base laboratories in electronic formats that were readily entered into the database.

A contamination assessment report template was developed for the FDEP DSCP that focused on presenting data in table and figure format to minimize the amount of text in the body of the report. Data from the database was electronically queried to construct the report data tables, thus minimizing the time to create the tables and potential human error associated with manually transcribing data into the report tables. Upon notification from FDEP that the reports were final, the database and the reports were submitted to FDEP on CD ROM. FDEP will include the data and the reports in the FDEP DSCP database. An average of three months was spent conducting a rapid assessment at a site and submitting the draft report to the FDEP.

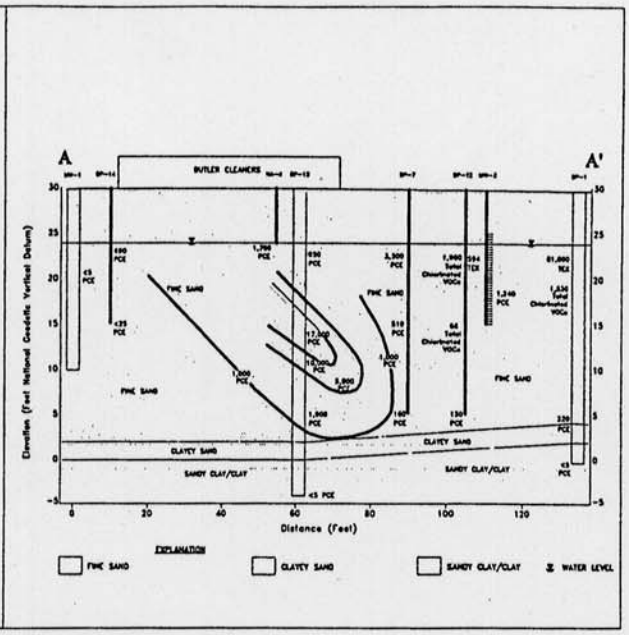
6.0 RISK-BASED CORRECTIVE ACTION (RBCA) EVALUATION AND REMEDIAL ACTION PLANNING

Following completion of the contamination assessment reports for the eight DSCP Jacksonville sites, RBCA evaluations were conducted for each of the sites to identify chemicals of concern, concentrations of the chemicals of concern in affected media (soil, groundwater, and/or surface water), potential routes of exposure relating to human health and the environment, and appropriate clean-up levels for each site. Upon reviewing the RBCA evaluations, the FDEP will decide on the future action for each site.

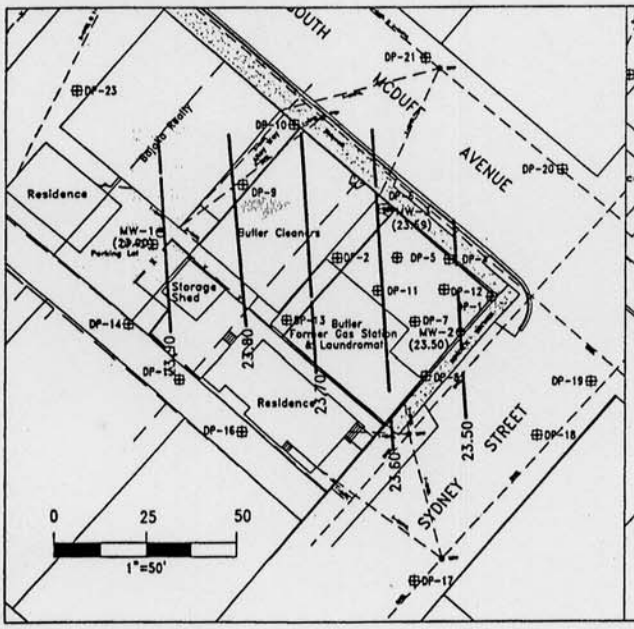
At sites where extensive soil and groundwater contamination exists that presents significant risks to human health and the environment, remedial action will be conducted. Remedial action options include monitoring only, natural attenuation, soil vapor extraction, air sparging, hydraulic control and physical barriers, and innovative technologies. Innovative technologies that have been proposed consist of co-solvent injection and chemical oxidation. Pilot testing for the innovative technologies will be performed prior to full implementation of a remedial system.



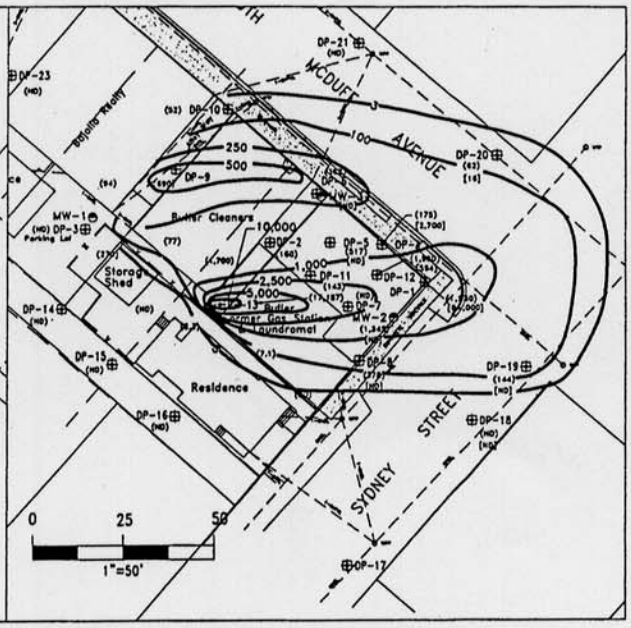
Sampling Location Map



Geologic Cross Section

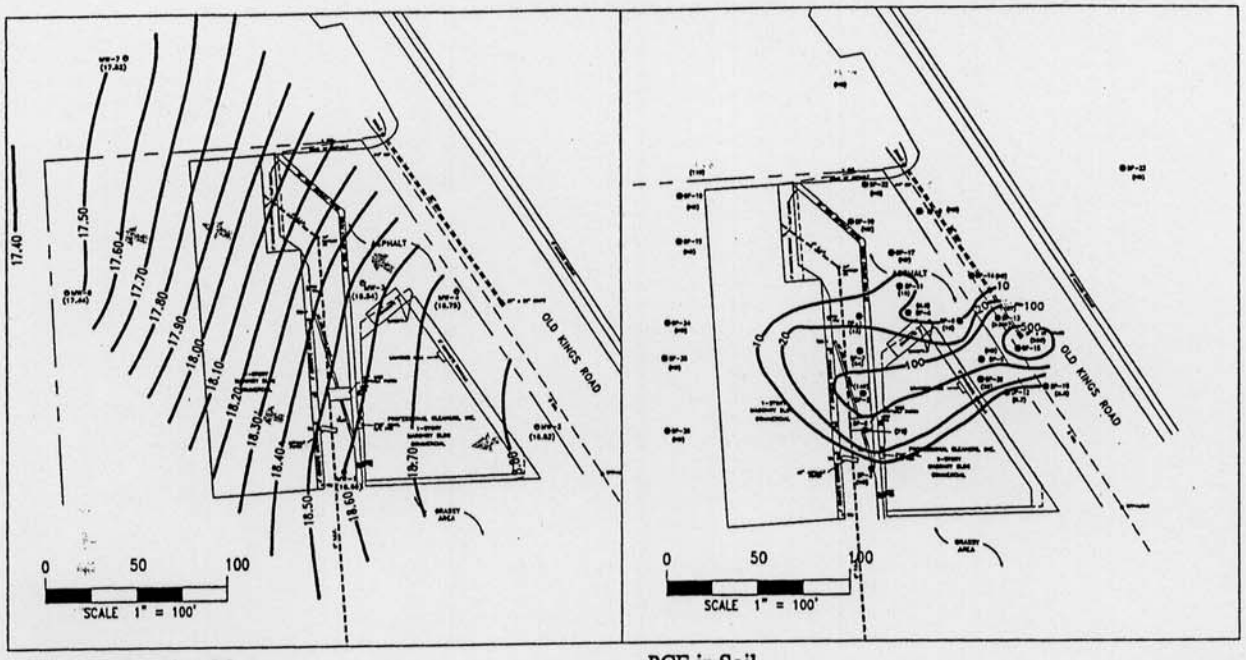


Groundwater Flow Map



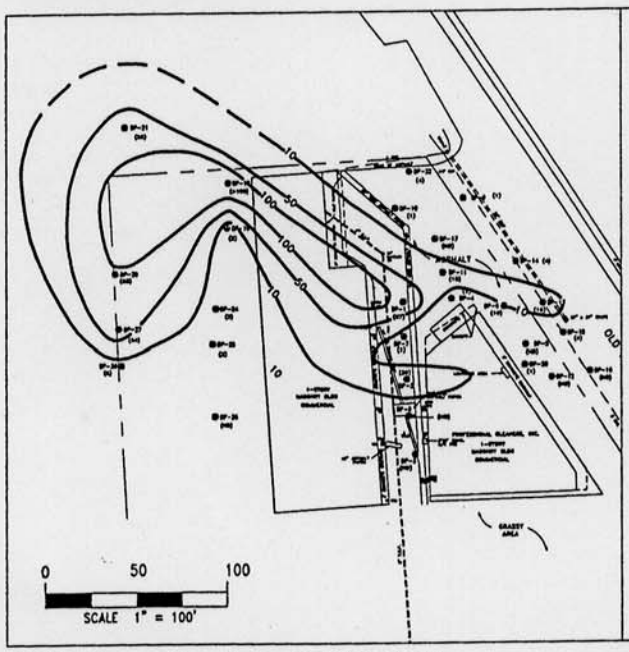
Total Chlorinated Ethenes in Groundwater

FIGURE 1: Rapid Assessment Data, Butler Cleaners, Jacksonville, Florida

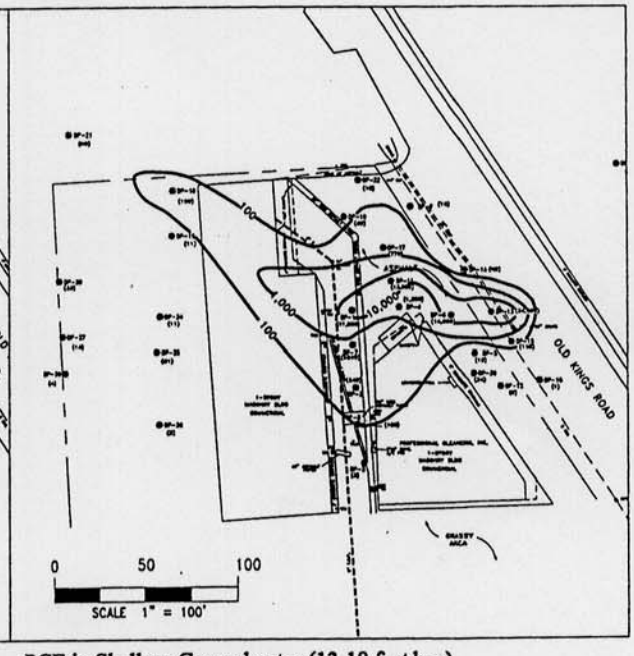


Groundwater Flow Map

PCE in Soil



PCE in Deeper Groundwater (25-28 feet bgs)



PCE in Shallow Groundwater (13-18 feet bgs)

FIGURE 2: Rapid Assessment Data, Professional Cleaners, Jacksonville, Florida

7.0 SUMMARY AND CONCLUSIONS

With limited funding and a large number of drycleaning-solvent sites in the DSCP, FDEP has developed an aggressive goal for the DSCP of moving sites from the assessment phase to remediation within one year. The eight sites discussed in this paper were the first sites to be characterized for FDEP under the DSCP; these eight sites were assessed during a 10-week period using rapid assessment tools and methods.

Using rapid assessment tools, geological and hydrogeological evaluation, on-site soil and groundwater chemical analysis, and experienced in-field decision making, rapid contamination site assessment was completed with a minimum number of fieldwork phases. Initially, it may appear that the rapid assessment approach is more expensive (because of the mobile laboratories and other rapid assessment tools) than conventional assessments. However, conventional site assessments often involve numerous mobilizations, which require separate work plans and cost estimates; in addition, the conventional process is often more costly and lengthy because it can extend the site assessment process by several months to many years.

The number of soil and groundwater samples obtained during rapid site assessments is greater than the number of samples obtained using conventional assessment methods, thereby providing greater control of the extent of soil and groundwater contamination. The average cost per site assessment for the eight drycleaning-solvent sites discussed herein was approximately $60,000, probably less than a comparable, conventional site assessment.

The rapid assessments were completed using experienced on-site staff, who evaluated and interpreted real-time data and made key decisions for guiding and completing the assessment *while on site*. This was key to accomplishing the rapid site assessments with minimal mobilizations.

The rapid assessment approach used by the FDEP for the DSCP provides the following advantages:

- completing assessments within three to four months: average cost 30 to 50 percent less than conventional assessments, average time 50 percent to more than 100 percent less than conventional assessments.
- rapid assessment tools enable greater numbers of soil and groundwater sampling points than conventional assessments. More samples are collected both vertically and horizontally, providing a better three-dimensional definition of chemicals of concern in soil and groundwater.
- immediate identification of potential risks to human health and the environment.
- immediate identification of the need to perform interim remedial actions.

By using the rapid assessment tools and methods discussed in this paper, the eight FDEP DSCP Jacksonville assessments were conducted more cost efficiently than if conducted using conventional assessment techniques. Time and resources for the assessment phase were reduced, and more FDEP DSCP resources were available for remediation. Meeting the aggressive FDEP DSCP goal of "assessment to remediation" within one year was facilitated by the rapid assessment approach.

8.0 REFERENCES

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