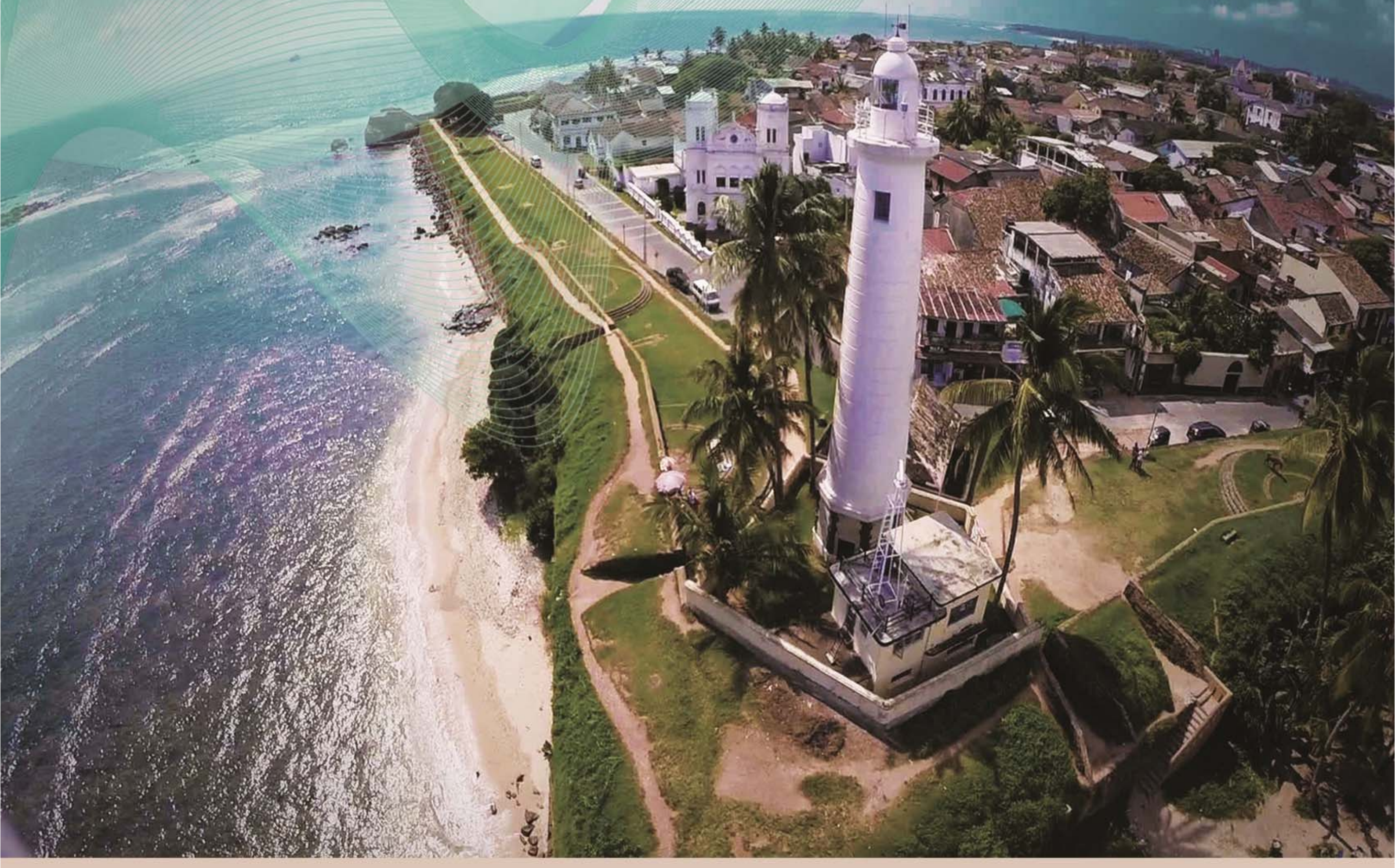
ACEPS 2015

Proceedings of the 3rd International Symposium on Advances in Civil and Environmental Engineering Practices for Sustainable Development



Faculty of Engineering,
University of Ruhuna,
Hapugala, Galle, Sri Lanka.
9th March 2015

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Proceedings

3rd International Symposium on Advances in Civil and Environmental Engineering Practices for Sustainable Development

ACEPS 2015

Department of Civil and Environmental Engineering
Faculty of Engineering
University of Ruhuna
Hapugala, Galle, Sri Lanka

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Keynote Address

Property Line Contamination Issues and Associated Risks to Buildings plus Cross-Contamination Issues & Water Supply Protection

by

Joseph E. Odencrantz
(Principal and Owner, Tri-S Environmental, California, USA)

Joe Odencrantz is a California-based environmental and water consultant with over twenty-five years of experience in the private sector. Dr. Odencrantz is a water and environmental expert with a unique set of qualifications and experience that spans from traditional civil and environmental engineering to current state-of-the-art investigation and remediation techniques. Dr. Odencrantz founded Tri-S Environmental (Tri-S) in 1994 and continues setting new standards of excellence in the practice of water and environmental management. He directs routine and complex analysis, investigation, vapor intrusion, water treatment and remediation projects on behalf of a variety of clients.

Property Line Contamination Issues and Associated Risks to Buildings plus Cross-Contamination Issues & Water Supply Protection

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Abstract: *Vapor phase transport of petroleum hydrocarbons and chlorinated solvents released into the subsurface is a challenging problem that requires special investigation and interpretation techniques. A case study is presented that illustrates the potential issues that can arise from historical release(s) of volatile organic compounds (VOCs-such as perchloroethylene [PCE]) to the subsurface and then into buildings (vapor intrusion). Site owner/developers are faced with deciphering fact from possible conjecture from professionals hired to conduct site assessments. Lateral migration of vapor contamination from one property to another can result in unnecessary burdens to properties adjacent to a property where a significant release occurred.*

Investigators faced with drilling through historical releases of chlorinated solvents in the subsurface should proceed with caution to avoid creating additional contamination issues (cross-contamination), i.e. prevent the situation from getting worse. A case study is presented that demonstrates the challenges that arise from drilling through known chlorinated solvents in soil into shallow groundwater.

Keywords: *Vapor intrusion, Chlorinated solvents, PCE, Cross-Contamination, Water supply, Property line.*

1. INTRODUCTION

Managing both petroleum hydrocarbon and chlorinated solvents releases to the subsurface is a large challenge for developers and new property owners faced with dealing with contamination emanating from adjacent or adjoining properties. Before rushing to judgment on the decision to move forward with subsurface investigation and remediation on a new property owner's site, a proper independent evaluation/study (due-diligence) of the subsurface contamination on adjacent properties should be conducted. A case study is presented that is based on a soil vapor extraction system that was put in operation after a consultant, who was engaged to perform an environmental assessment for an impending real estate transaction, seemingly took the assignment and then recommended soil remediation on the new property owner's site. It was demonstrated at a later date that the vapor contamination plume was originating at a property to the north, not the new owner's site.

A consultant hired by a power company was engaged to perform a site assessment on a piece of land donated by a city to the power company so that the terminus of a large, underground power trunk line could be constructed. The donated piece of land was investigated by the power company's consultant to determine if there were any subsurface concerns as part of the grading/shoring operation of the proposed structure. The consultant discovered a shallow PCE vapor plume in the shallow soils with concentrations as high as 58,000. micrograms per cubic meter (ug/m3) of PCE and proceeded to drill through this vapor cloud into the groundwater system in the following months without any special precautions. As a result, the groundwater concentrations were elevated for it appeared that the consultant dragged contamination into the groundwater system. After expert evaluation, additional monitoring wells were subsequently constructed using drilling practices designed to minimize the cross-contamination from the soil vapor into the groundwater system.

2. PROPERTY LINE CONTAMINATION AND PROPER ENVIRONMENTAL ASSESSMENT DEMONSTRATE REMEDIATION INADEQUACIES

Site: https://geotracker.waterboards.ca.gov/

As part of the environmental due-diligence of a commercial property transaction, the American Society for Testing and Materials (ASTM) Standard Practice for Environmental Site Assessments-Phase I Environmental Site Assessment Process (ASTM 1527-13) was utilized. ASTM 1527-13 states in Section 9.4.1.4 on page 18 "To the extent that indications of past uses of adjoining properties are visually and/or physically observed on the site visit, or are identified in the interviews or record review, they shall be noted and past uses so identified shall be described in the report if they are likely to indicate recognized environmental conditions in connection with the adjoining properties or the property." As such, an environmental investigator is responsible for examining the environmental records and current environmental remediation activities at adjoining sites/properties to the subject property for which a purchase is being contemplated. Figure 1 below is a cross-section approximately 10 m to the north of the property line of the subject property that shows the extent of tetrachloroethylene (PCE) plume. The geology of the area is a comprised of alternating sand and clay/silt layers that vary in thickness from 5 to 10 feet (~ 2.5 m) generally speaking. The fine-grained layers tend to trap or store chlorinated solvents and the vapors are slowly released over time (by molecular diffusion-much like perfume/cologne escaping from an opened bottle).

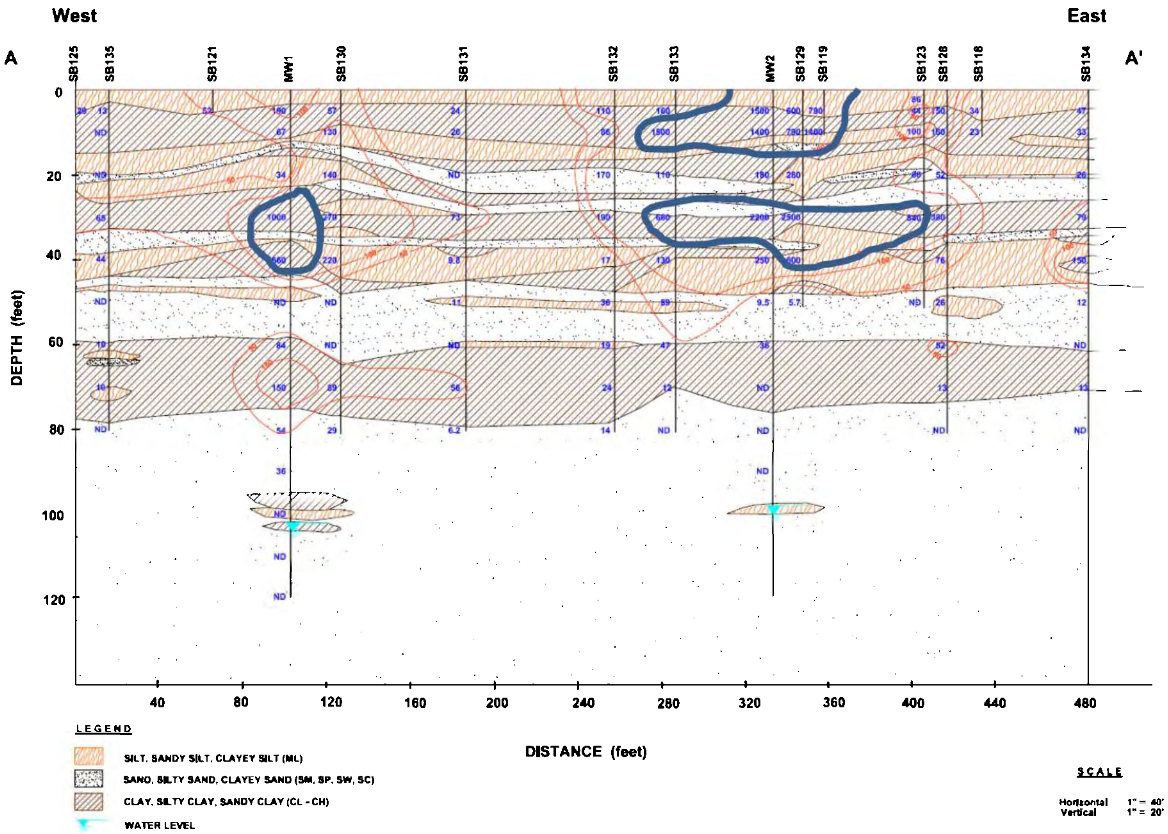

Figure 1. Cross-section of PCE contamination with depth (ug/kg) approximately 35 feet (10 m) north of the property line of the subject site. Bolded lines/shapes represent the 500 ug/kg contour lines.

In the year prior to the consultant performing the due-diligence for the prospective property owner, an investigation report was published (public domain and available at a local environmental regulatory agency) for the site to the north of the property line which contained Figure 1. The investigation report also discussed the site revitalization and decommissioning plan that was slated to take approximately one year. This site was a large battery manufacturing facility, in business for over 40 years, midway through the process of decommissioning at the time the subject property owner's consultant was reporting on the subject properties due diligence investigation. The consultant did not report this information to the prospective property owner but focused his investigation on residual PCE from a former clarifier on the subject property that was investigated, remediated (by vapor extraction) and closed by the regulatory agency twelve years earlier. The consultant proposed and performed an active soil gas survey that showed low-levels of PCE vapor on the subject property. The consultant proposed to perform a vapor extraction remediation to reduce the vapor concentrations in the subsurface on the subject site to regulatory levels for indoor air. The consultant did not disclose to the client the possibility that PCE on the subject site could be coming from the large, former manufacturing facility just north of the property line. The consultant convinced the new subject property owner to re-open this previously closed site with the local regulatory Agency's voluntary site cleanup program.

Table 1. PCE concentrations in discrete soil samples on the property to the north and the vapor concentrations on the subject site. PL-Property Line.

Property Line and PCE Concentrations

		Depth in Feet Below Grade									
On Property to the North		4.5-5	9.5-10	19.5-20	25-25.5	29.5-30	35-35.5	39.5-40	45-45.5	49.5-50	
Sample #	Ft from PL	PCE (ug/kg)-Soil Matrix Concentration									
1	18				13		1,100		110J		
2	20	160	1,500	110		660		130		89	
3	23	190	67	34		1,000		660		<5.7	
4	31	600	790	280		2,500		600		5.7	
5	35				380		1,400		180		
6	39	790	1,400								
7	41	1,500	1,400	180		2,200		250		9.5	
On Subject Property		5		15		25					60
	Ft from PL	PCE (ug/L)-Vapor Phase Concentration									
A	7	31		21		4,200					70

Shallow (<10 ft) Source Area Matrix Concentration over 1,000 ug/kg

Deeper (>25 ft) Source Area Matrix Concetration over 1,000 ug/kg

Soil Vapor Concentration in Deeper Depths from Source Area over 1,000 ug/L

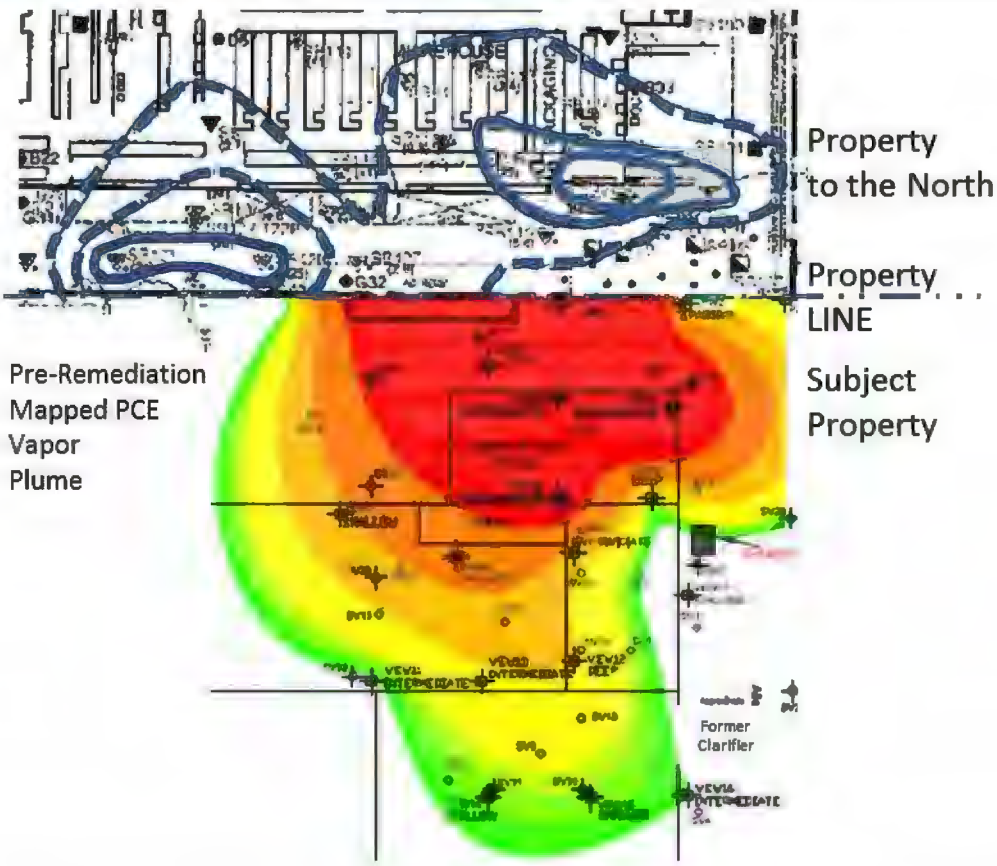

Figure 2. PCE vapor plume depicted by each property owner's consultant prior to vapor extraction on the subject site owner's property. The red color indicates a maximum PCE concentration on the subject site of approximately 200 ug/L.

Table 1 contains the PCE concentrations in soil on the site to the north, as a function of depth and distance from the property line, and the resulting soil vapor concentrations on the subject site. Figure 2 shows the contours of PCE vapor on the property to the north at five feet below the surface prepared by their consultant and the pre-remediation vertically averaged PCE vapor contours on the subject site (5 to 60 feet below the surface) prepared by the consultant to the subject site owner. The full vertical extent of contamination on the property to the north is shown in Figure 1. The consultant for the subject site convinced the new property owner that the site would be cleaned up with relative ease and within a year after the property owner's purchase of the site. As you can see by the consultant's own depiction of the PCE vapor plume in Figure 2 in red, the PCE is clearly emanating from the property to the north of the property line. The former clarifier on the subject site is mapped near the bottom tip/green portion of the plume and clearly not the source of PCE vapors on the subject site.

The consultant to the subject site owner was unable to remediate the subject site to regulatory limits after four years of remedial activities using vapor extraction because the source of PCE vapors was located on the other side of the property line. The consultant kept promising his client that cleanup would be completed with more time and money. That did not happen and after approximately four years, the property owner realized that something was amiss with the situation. The local regulatory agency will not close the site until the remediation is completed, which is now contingent upon indoor air concentration limits of PCE. In addition, the regulatory agency is requiring that other VOCs to be reduced below strict standards for human exposure. The project is now in a state of flux and the property owner is considering suing the property to the north for cost recovery and to assume the responsibility for site cleanup. The consultant for the subject site was released of his duties and the property owner hired a competent and ethical environmental professional to assume oversight of the cleanup strategy.

The PCE contamination from the source left in place at the property to the north creates a vapor intrusion risk to buildings in vicinity of the plume. The recent regulatory standards in effect at most states in the USA have a component of soil gas and indoor air quality assessment for remediation alternative evaluations. At this particular site, the site was closed by the local oversight Agency twenty years ago and would not have been re-opened by the State or the County based upon any residual vapors from the clarifier remediation. The previous consultant has created regulatory challenges and legal liability for the new subject property owner.

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3. CROSS-CONTAMINATION ISSUES & WATER SUPPLY PROTECTION

Site: https://geotracker.waterboards.ca.gov/

The consultant hired by a power company performed a soil gas survey at the property donated to them by a city in which the construction of the terminus of a large subsurface power line (500 kilovolt [kV]) was to be installed. The consultant discovered as much as 58,000. ug/m3 in the shallow soil gas (5 feet below grade) and then proposed to collect both discrete soil and groundwater (hydropunch) samples to further characterize the extent of contamination. The consultant discovered that as much as 180 ug/kg of PCE existed at the site approximately 20 feet below grade underneath the previously determined soil gas hot spot. Figure 3 is a schematic diagram of the facts of the PCE regime prior to entering the groundwater system to collect groundwater samples at the site.

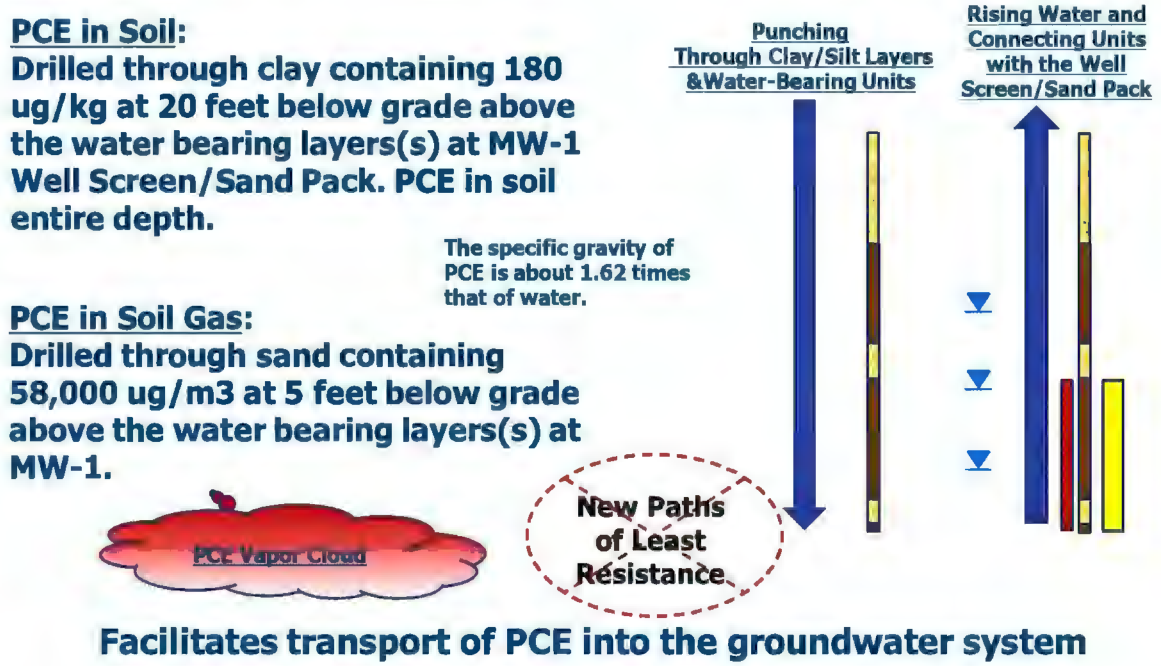

Figure 3. Potential Problems When Drilling Through PCE in Soil/Soil Gas.

The consultant's next step in the site characterization process was to collected groundwater hydropunch samples in the shallow groundwater using a Geoprobe® direct-push drilling technology. The consultant drilled through both the elevated PCE soil gas concentrations in the shallow soils and the PCE concentration of 180 ug/kg at 20 feet below ground surface until they reached the shallow-most groundwater. First groundwater was encountered at approximately 28 feet below ground surface. Upon reaching the groundwater regime, the water rose up the hole created by drilling to approximately 17 feet below grade. The water was under pressure (confined/semi-confined) and rose thirteen feet in the borehole. There are multiple problems created by this investigatory method: a. dragging down of PCE vapor into groundwater, b. dragging down of soil cuttings that contain PCE into groundwater, c. the cross-contamination of groundwater that rose up within the borehole with PCE in the soil column (groundwater water may have not been impacted with PCE prior to the drilling activities. ASTM D6724-04 (2010) Standard Guide for Installation of Direct Push Groundwater Monitoring Wells provides excellent guidance and states "For direct push methods to provide accurate groundwater monitoring results, precautions must be taken to ensure that cross-contamination by "smearing" or "drag-down" (that is, driving shallow contamination to deeper levels) does not occur, and that hydraulic connections between otherwise isolated water bearing strata are not created."

4. CONCLUSIONS

The two main topics in this paper are associated with the proper characterization and management of PCE in the subsurface. The first topic of the paper addressed the importance of investigating properties that are in the vicinity of a property that is potentially going to be purchased by an entity. If the due-diligence is flawed, the future property owner of the property which is the subject of due-diligence can be faced with unexpected monetary and regulatory liabilities. Legal liabilities are also a possibility for improper due-diligence may lead to lawsuit with the surrounding properties that could have impacted the subject property.

The second topic of this paper addressed the critical importance of minimizing cross-contamination when investigating chlorinated solvents in the subsurface. When an investigator knowingly drills through known PCE-impacted soil/soil vapor into confined groundwater, there are a host of problems that can result. When drilling through known contamination, preventative measures must be taken. If the investigator causes groundwater contamination as a result of hasty and improper investigation methods, large liabilities can result to both the site owner and the investigator. An ounce of prevention is worth a pound of cure when drilling through chlorinated solvent impacted sites.

5. ACKNOWLEDGMENTS

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6. REFERENCES

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