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Sent: Friday, May 05, 2006 8:57 AM
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Cc: Otto, William; Sieger, Thomas
Subject: DPH Memo on Residential Sub-Slab Soil Vapors and Redi-Quik DryCleaners
Attachments: RediQuik DC DPH Tech Memo2 0506.pdf

Attached is the final DPH memo on the findings of the most recent DPH investigation of sub-slab soil gas at the Dauer household in West Allis.

I will be mailing you each a signed copy.

Please contact me if you have any questions or concerns regarding this memo.

Regards,

Henry Nehls-Lowe
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CORRESPONDENCE / MEMORANDUM

STATE OF WISCONSIN

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Date: May 5, 2006

To: Jim Schmidt, Wisconsin DNR – Southeast Regional Office

From: Henry Nehls-Lowe

Subject: **Residential Sub-Slab Soil Vapor Investigation – Redi-Quik Dry Cleaners**

Tetrachloroethylene (PCE) levels in soil vapors from beneath a West Allis home, along with unsafe levels previously found in the home, showed vapor migration and intrusion is a completed indoor air pathway from the nearby dry cleaner. This underscores the need for installing a sub-slab vapor depressurization system to mitigate PCE impacts to indoor air of the home. The high PCE concentrations in soil vapors suggest contaminated soils are very close or in direct contact with the home's foundation. Should the concrete floor be compromised and soil vapors reach the indoor air, the highest observed level of PCE in soil vapors would pose an *urgent public health hazard*. Any drilling, digging, or excavations in the basement should include rigorous ventilation and other measures to protect the health of workers and residents. The need remains to investigate nearby homes for vapor migration and intrusion pathway.

Background and Vapor Intrusion Investigation

In follow-up to an indoor air investigation for vapor migration and intrusion to the indoor air pathway of a home at 1361 95th Street, West Allis, staff with the Division of Public Health (DPH) collected soil vapor samples from directly beneath the basement floor of this home. Soil vapor samples were tested to verify the completion of the vapor migration pathway. This residential property is immediately north of the Redi-Quik Dry Cleaners, an operating business establishment located at 9508 West Greenfield Avenue (DNR Facility ID 241170490).

As you know, on April 3, 2006, DPH reported to DNR about elevated levels of tetrachloroethylene (PCE) found in the indoor air of this West Allis home (DPH 2006). DPH concluded that this posed a *public health hazard* to residents due to an unacceptable level of increased cancer risk. However, DPH found that these levels were not likely to cause non-cancer health effects associated with much higher tetrachloroethylene exposures. DPH recommended that the homeowner open basement windows to remove any vapors due to vapor intrusion. DPH also recommended that the dry cleaner investigate for vapor migration and intrusion to the indoor air pathway in nearby homes. In follow-up, DPH planned to conduct another round of indoor air samples and also collect sub-slab soil vapor samples. This current memo summarizes the findings of DPH's sub-slab soil vapor investigation.

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Soil Vapor Sampling Methods and Results

On April 10th, 2006, DPH staff visited this West Allis home and installed 3 sample ports in the basement concrete floor (Figure 1). Two sample ports (Port A and C) were installed along the southern basement wall, which is closest to the Redi-Quik dry cleaner and areas of high soil contamination by PCE on the residential property. Sample Port A was placed 5 feet, 1 inch from the south wall and 4 feet, 4 inches from the east wall. Sample Port C was placed 4 feet, 5 inches from the south wall, directly under the staircase leading to the main floor. A third sample port (Port B) was installed near to the northern basement wall in order to evaluate for varying PCE concentrations further from the source. Sample Port B was placed 12 feet, 4 inches from the west wall and 6 feet, 6 inches from the north wall.

Each soil vapor sample port, manufactured by Entech Instruments Inc., consisted of a stainless steel, internally threaded tube, $\frac{3}{8}$ inch in diameter and 2 $\frac{1}{2}$ inches long, with a $\frac{1}{2}$ inch diameter collar (Figure 2). At each sample location a $\frac{3}{8}$ inch diameter hole was bored through the concrete floor, which followed the drilling of a 1 inch deep and 1 inch diameter countersink hole. After drilling the $\frac{3}{8}$ inch hole and when the drill tip came in contact with sub-slab soils, the tip was observed dry at Sample holes A and C, and wet at Sample hole B. A sample port was then inserted into each sample hole to be flush with the floor and sealed by filling the countersink with water-based, non-acrylic cement grout. Once the grout cured DPH staff closed sample port with a stainless steel bolt and the recessed head was sealed with a rubber stopper.

On April 11th, DPH staff again visited the West Allis home 24-hours later to collect a soil vapor sample from each of the three sample ports using 6-liter evacuated SUMMA[®] canisters (Figure 3). The 24-hour delay in collecting the samples allowed sub-slab soil vapor conditions to re-stabilize after installation of the sample ports. Staff used stainless steel couplings and tubing to connect the sample port to the canister. This connection used a photo-ionization detector (PID) to purge basement indoor air from the tubing and couplings. This PID, capable of measuring total volatile organic compounds (VOC) in the single-digit, parts-per-billion range, was also used to screen soil vapor samples for VOCs. To avoid contaminating indoor air, exhaust from the PID was captured in a mylar gas sample bag. Once VOC readings on the PID stabilized, basement air was considered purged and the valve connected to the PID was closed. The soil vapor sample was then collected over approximately 15 minutes by slowly opening the valve on the canister.

The canisters were submitted to the Wisconsin State Laboratory of Hygiene for analysis by gas chromatography/mass spectroscopy following EPA Method TO-14a (EPA 1999). PCE was detected in all sub-slab soil vapor samples, with 63,328.4 $\mu\text{g}/\text{m}^3$ at sample Port A, 14.89 $\mu\text{g}/\text{m}^3$ at sample Port B, and 2,030,160.40 $\mu\text{g}/\text{m}^3$ at sample Port C (Table 1).

Table 1: Sub-Slab Soil Vapor Concentrations of Tetrachloroethylene
 April 11, 2006
 1361 95th Street, West Allis, Wisconsin

Sample ID	Sample Port	Sample Location in Basement	PID Screened Level (ppb)	PCE Concentration by Method TO-14	
				ppb	$\mu\text{g}/\text{m}^3$
RQDC-SSV-01	Port A	Southeast Corner	6,650	9,313.0	63,328.40
RQDC-SSV-02	Port B	North Room	187	2.19	14.89
RQDC-SSV-03	Port C	South Central	>199,000	298,553.0	2,030,160.40

Discussion

The levels of PCE found in soil vapors directly beneath the West Allis home clearly demonstrates that vapor migration and intrusion to indoor air is a completed pathway of contamination coming from the adjacent Redi-Quik dry cleaner. Recent indoor air sampling and prior environmental investigations of this residential property found elevated levels of PCE that were unusually high and are not apparently coming from other sources inside of the home. The concentration of PCE in the soil vapor sample from Port C of 2,030,160 $\mu\text{g}/\text{m}^3$ is extremely high, indicating that contaminated soils are either very close by or in direct contact with the foundation of the home.

It should be noted that the level of PCE recently found in the indoor air of this West Allis home during the March sampling was as high as 231.6 $\mu\text{g}/\text{m}^3$, about 1,000 times lower than the highest measured soil vapor concentration. However, should the integrity of the concrete floor be compromised and such a level of PCE reach the indoor air of the home, this would pose an *urgent public health hazard* to workers and residents. Such a level of PCE is 2,000 times above the ATSDR acute Minimal Risk Level (MRL) of 1,000 $\mu\text{g}/\text{m}^3$. This MRL was derived from a human study that found an increased rate of neurological effects on volunteers exposed to a PCE concentration of 340,000 $\mu\text{g}/\text{m}^3$ for 4 hours/day over 4 days (ATSDR 1977). A PCE concentration of 2,030,160 $\mu\text{g}/\text{m}^3$ also exceeds the NIOSH Immediately Dangerous to Life or Health (IDLH) of 1,020,000 $\mu\text{g}/\text{m}^3$ (or 150,000 ppb). The U.S. Occupational Safety and Health Administration defines an IDLH as "an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere" (NIOSH 2006). Therefore, measures should be taken to ensure that the soundness of the basement floor remains intact and protected at the West Allis home. Any

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References

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Please contact me if I can be of further assistance to you regarding this matter.

cc: Binyotti Amungwafor – DNR Southeast Regional Office
Terry Evanson – DNR Central Office
Terry Brandenburg – West Allis Public Health Department
Tom Sieger – Division of Public Health
Property Owner of 1361 95th Street, West Allis, Wisconsin

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planned excavations or drilling activities into the basement floor should include rigorous ventilation and other measures to protect the health of workers and residents.

The wet sub-slab soils observed at Sample hole B and subsequent lower soil vapor PCE concentrations from Sample Port B suggests that one of several conditions may exist. One condition may be that PCE in soil vapors have not migrated this far north of the source. An alternative condition may be that saturated soils at this location inhibit the free movement of soil gas vapors. However, the data from Sample Port B should not be used to infer PCE has not migrated beyond the West Allis home and is not affecting other adjacent homes. Consequently, DPH continues to recommend that nearby homes be investigated for completion of the vapor migration and intrusion pathway.

Conclusions

- The levels of PCE found in soil vapors beneath the West Allis home, along with unsafe PCE levels previously detected in indoor air, demonstrates that vapor migration and intrusion is a completed pathway and underscores the need for a mitigation system that reduces the impacts to indoor air of the home.
- The high PCE concentrations in soil vapors suggests contaminated soils are either very close by or in direct contact with the foundation of the home.
- Should the concrete floor be compromised and highest PCE levels in soil vapors reach the indoor air of the home, this would pose an *urgent public health hazard* to residents.

Recommendations

- Mitigation actions are needed to prevent vapor migration to indoor air of the home.
- Any excavations or digging into the basement should include rigorous ventilation and other measures to protect worker and residential health.
- DPH continues recommending that nearby homes be investigated for completion of the vapor migration and intrusion pathway.

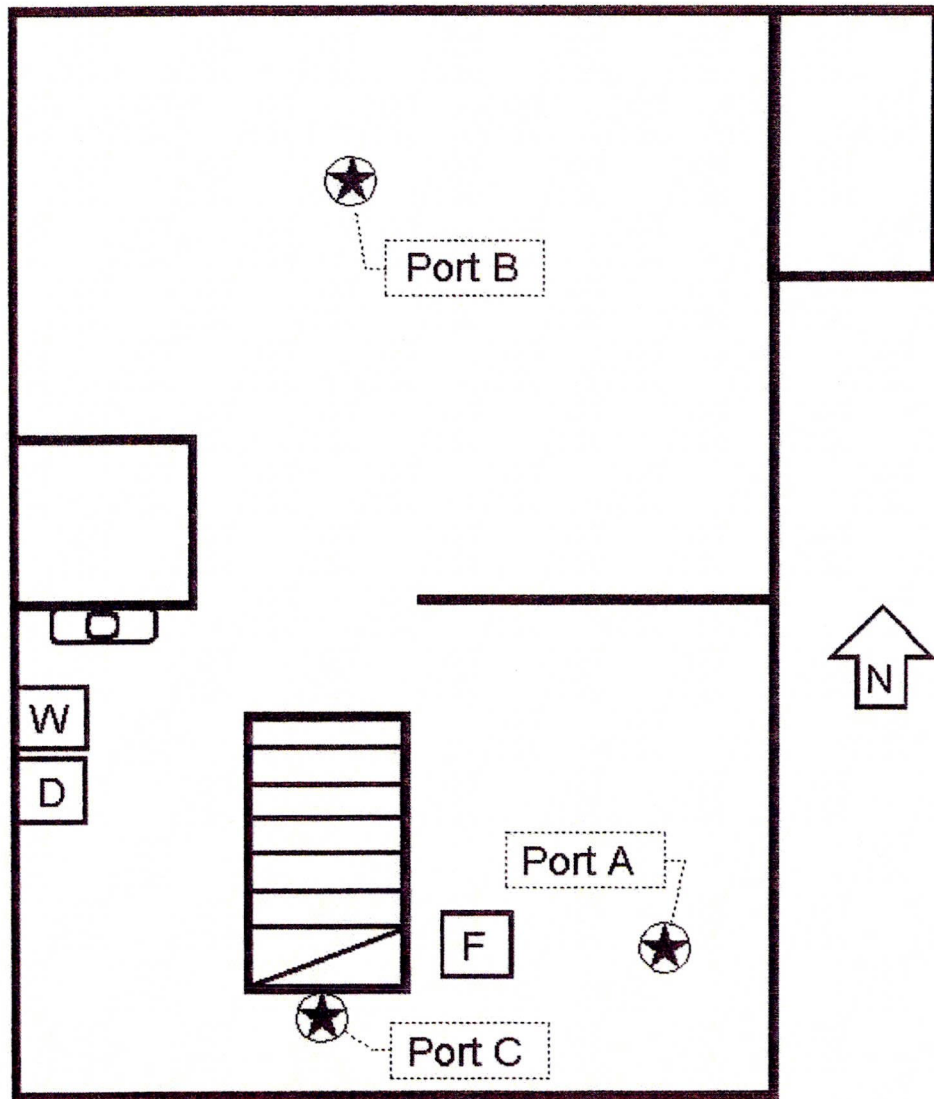


Figure 1: Sub-slab soil vapor sample locations in basement of 1361 95th Street, West Allis, Wisconsin, April 2006. (drawing not to scale)

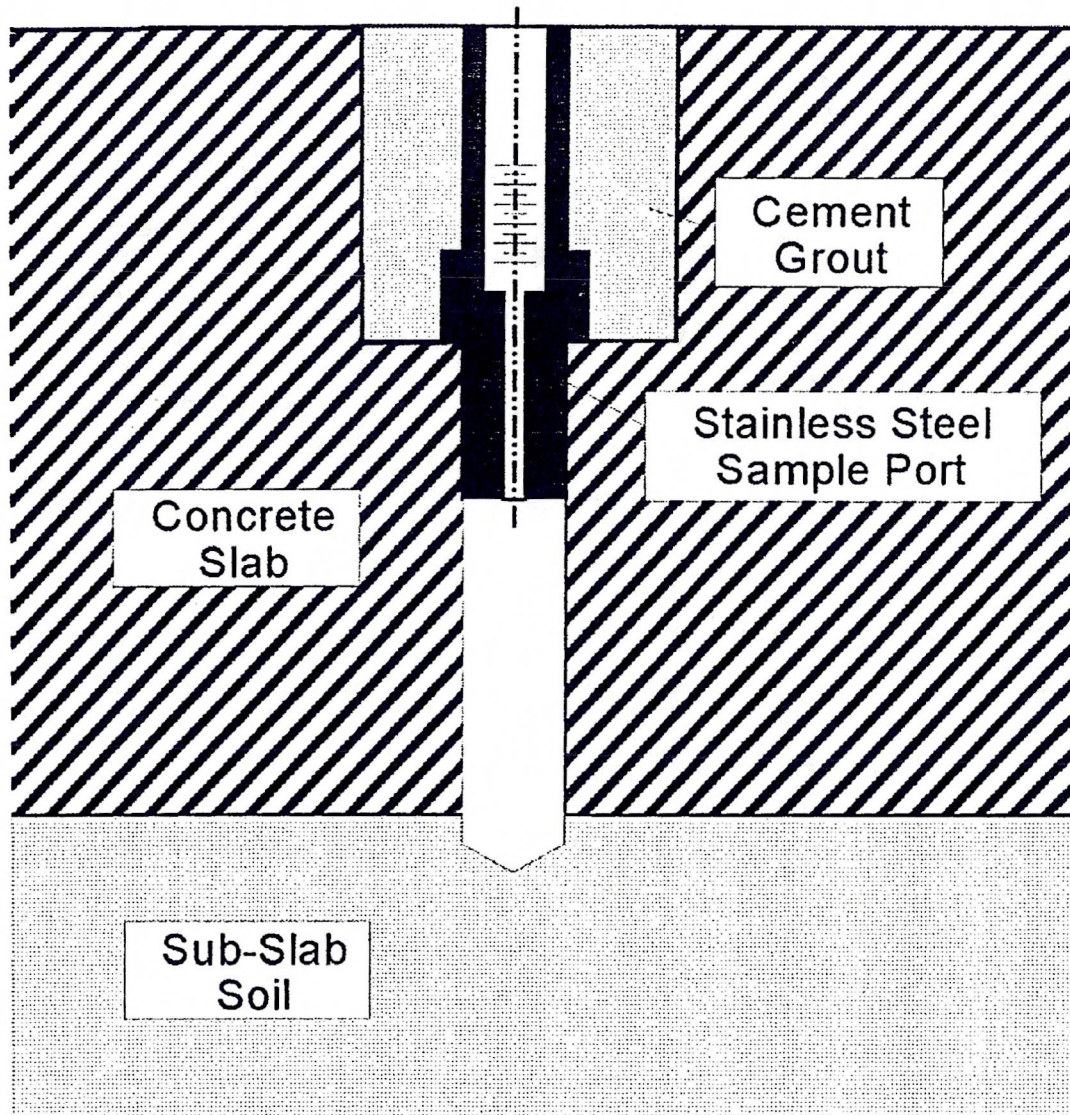


Figure 2: Schematic of probe for sub-slab soil vapor sampling.



Figure 3: Sampling of sub-slab soil vapors, sample Port B, West Allis home, April 2006.