Drews, Mark D - DNR

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Sent: Tuesday, September 18, 2007 2:13 PM
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Cc: [ces.uwex.edu].Patricia.nagai; [cityofracine.org].Marcia.Fernholz; [dewittross.com];.ahg
Subject: Racine community gardens, DHFS memo

Attachments: DH&FS (Div of Health) memo Sept 10 2007(dft2).doc

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DH&FS (Div of Health) memo Sep...

Mark,

Attached is my public health interpretation of the recent soil and soil vapor work done at the SC Johnson community gardens in Racine. Please call with any questions.

Best regards,

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Division of Public Health
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Date: *September 18, 2007*

To: *Mark Drews, WDNR, R&R Program*

CC: *Marcia Fernholz , Racine County Health Department*
Patricia Nagai, Ph.D., University of Wisconsin Extension, Racine

From: *Robert Thiboldeaux, Ph.D., Toxicologist*

Subject: *Tetrachloroethene in soil at the Racine Community Gardens*

Background and statement of issues

Following the discovery of drycleaner solvents in soil and groundwater on and adjacent to the Express Drycleaner operations in Racine, questions have been raised regarding risks of exposure to the public working in the S.C. Johnson Community Gardens. Northern Environmental, Inc. was contracted by the property owner, Ehrlich Family Limited Partnership ("Ehrlich") as the environmental consultant to sample soil and soil gas on the garden property. This work was performed with regulatory oversight by the Wisconsin Department of Natural Resources, and with technical input on sampling locations from University of Wisconsin-Racine Extension staff. This memo is in response to a request by WDNR to provide a public health perspective on the initial sampling results.

Previous work by Northern Environmental Report (July 16, 2007, ECI-01-2300-3057) reported significant concentrations of tetrachloroethene (PCE) as the primary contaminant beneath the Ehrlich property. Subsequent work reported August 1, 2007 (NEI, 2007) investigated soil contamination at 9 locations on within the community gardens. Seven of the samples were taken in the northwest corner of the gardens, nearest the drycleaner where the possibility of contamination from surface water runoff was greatest. Two other samples were taken on the eastern side of the gardens in order to partially characterize the entire garden. The samples were taken at the 6 inch soil depth and at 24 inches. These sampling depths were intended to reflect the most common exposures from handling composed soils added to the garden surface, as well as less frequent exposures from digging in deeper native soils.

Northern Environmental also sampled vegetables from the community gardens, in response to the possibility of plant uptake and accumulation of drycleaning solvents.

Public Health Issues

During discussions of the work plan proposal for the site, three potential exposure pathways to PCE were identified:

- *Incidental hand-to-mouth consumption of soil.*
- *Inhalation of PCE vapors emitted from contaminated soil.*
- *Consumption of garden plants grown in contaminated soil.*

Contamination of groundwater is a typical environmental concern at drycleaner sites. From a public health perspective, PCE and other drycleaning solvents in groundwater from this site is not yet a concern, since local residents are served by municipal water supplies.

Results.

The investigation by Northern Environmental reports PCE in soil samples throughout the garden property (Table 1). The most concentrated sample, 130 mg/kg, was from a sample taken at 24 inches below surface in a sod area a few feet to the west of the tilled area of the gardens (NEI, 2007). Of the remaining 8 sample locations from within the garden, one sample was 1.3 mg/kg and the others were at or below 1.2 mg/kg.

PCE in soil vapor reported at the sod area where PCE in soil was most concentrated was 6300 micrograms per Liter, or 930 parts per million. PCE in soil gas measured elsewhere was 2 ppm or less (Table 1).

Discussion.

The analytical results from the 9 sample locations were compared to the EPA Region 3 Risk-Based Concentration (RBC) values for residential soils. The RBCs use standard exposure assumptions to calculate a soil concentration that conservatively reflects a 1-in-one million increased lifetime cancer risk from chronic exposure to the chemical in soil. For PCE, this concentration is 1.2 mg/kg for residential soil. The one sample location that significantly exceeded these RBCs was beneath a grass-covered area outside of the tilled garden where no regular direct contact would be expected. Within the tilled gardens, the exposure frequency and duration is less than would be appropriate for comparison to the RBC. Similarly, PCE concentrations in the tilled soils are much less than would produce any acute effects. It can be concluded that due to the low concentration of PCE in the soil and the limited direct contact, no cancer risk or acute effects from PCE exposure are expected from contact with soil within the tilled garden area.

Table 1. Tetrachloroethene (PCE) concentrations in soil, S.C. Johnson Racine community gardens[1]

Sample i.d.	PCE detected in 6" deep soil (ppm)	PCE detected in 24" deep soil (ppm)	EPA screening value for transfer from soil to air[2] (mg/kg)	EPA Region 3 Risk-based concentration for residential soils (mg/kg)[3]
BA1	--	130	11	1.2
BA2	0.65	0.70	11	1.2
BA3	1.20	1.30	11	1.2
BA4	0.69	1.00	11	1.2
BA5	trace	0.04	11	1.2
BA6	0.06	0.07	11	1.2
BA7	0.08	0.38	11	1.2
BA8	trace	trace	11	1.2
BA9	0.03	1.2	11	1.2

[1]Results reported by Northern Environmental, Inc. Soil, Soil Vapor, and Vegetable Tissue Sampling Results, Express Cleaners. ECI 01-2300-3057. August 1, 2007.
[2]US EPA 1999. Region III Risk-based concentration table.
[3]US EPA. 2007. Region III Risk-based concentration table.
ppm: parts per million, or milligrams per kilogram

In the grass-covered area where soil PCE concentrations are highest, it is possible that PCE would diffuse into air just above this location at concentrations detectable by odor. It is not possible to accurately predict those PCE concentrations, nor any past exposure, given the rapid diffusion of PCE and daily fluctuations in atmospheric conditions. However, applying a conservative 100-fold concentration reduction from soil to air calculates to a concentration similar to that expected inside a dry cleaning facility. Such exposure to PCE might be possible under limited conditions for someone sitting for extended periods over the grass just outside the garden trellis wall.

The investigation by Northern Environmental did a reasonably thorough job of sampling the variety of vegetables, both root crops and greens, grown throughout the garden. In all 32 samples, no PCE was found above the limit of detection for the analytical method used, which was in the low parts per billion range. The fate of PCE and other chlorinated solvents in plants grown in contaminated soil is still an area of active study, with much of the research being driven by interest in phytoremediation methods. Doucette, *et al.* (2007) report some accumulation of trichloroethylene, a structurally related chlorinated solvent, in tree trunks, but little if any in leaves, fruits, or in vegetable crops. This is supported by Nzengung (2005; b) who reviewed studies indicating that PCE and chlorinated solvents are rapidly metabolized and transpired from plant tissues rather than accumulating. Overall, the evidence from this site and from related studies does not

indicate that people consuming garden plants from this location would have any exposures constituting a health concern.

Child Health Statement

Children active within the garden area would be expected to have greater actual exposures to PCE than adults, due to higher breathing rates and more hand-to-mouth activity. The risk-based concentration values used in this analysis account for this difference, and are designed to be protective of these sensitive members of the population.

Conclusion

There is no apparent past or present health hazard from exposure, by inhalation, direct contact, or consumption of plants, to PCE in soils within and adjacent to the S.C. Johnson community gardens in Racine. This is due to the low concentrations and limited exposure to PCE found in soil and garden vegetables.

Recommendations

In order to improve environmental quality and permit unrestricted use of the garden property, areas with PCE soil concentrations exceeding WDNR guidelines should be remediated or maintained to minimize any future exposure to the public.

References

Doucette WJ, Chard JK, Fabrizius CC, Petersen MR, Carlsen TE, Chard BK, Gorder K. 2007. Trichloroethylene uptake into fruits and vegetables: Three-year field monitoring study. *Env. Sci. Technol. 41:* 2505-2509.

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