RESTY

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

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August 31, 1999

File Ref: FID#241958310

Mr. Richard Maslowski
Glendale Community Development Authority
5909 N. Milwaukee River Parkway
Glendale, WI 53209

Subject: Crestwood Project - Preliminary Review Comments

Dear Mr. Maslowski:

The Wisconsin Department of Natural Resources (WDNR) has completed a preliminary review of the investigation reports and remedial action proposal submitted on your behalf by HNTB Corporation. We have received investigation reports dated March 1998 and May 1999, and a remedial action plan dated June 1999, for the Crestwood Area Site, as well as a Phase II environmental assessment dated May 1997 for the Crestwood Shopping Center site.

The investigations found perchloroethylene (PCE) and its associated breakdown products in soil and groundwater on both these sites, and it appears that the primary source was located on the Crestwood Shopping Center property. A plume of groundwater contamination from this source has been found to extend south of Silver Spring to a point somewhere between Custer Avenue and the Milwaukee River.

The proposed remedy was intended to address the PCE contamination in soil and groundwater on both the sites and also what has migrated from these sites. The remedy would involve soil vapor extraction in the source areas, coupled with a slurry wall to assist in dewatering and to help contain groundwater until acceptable levels are met. Additionally, bioremediation enhancement will be used near the Silver Spring right-of-way, which is not easily accessed for other forms of treatment. Finally, natural attenuation has been proposed as the remedy for the groundwater plume extending south of Silver Spring.

Our preliminary comments are directed primarily toward the investigation. A complete assessment of the remedial action proposals would not be appropriate until the investigation issues are resolved. However, it does appear that soil vapor extraction and natural attenuation could be involved in the final remedy for this site.

1. DNAPL – The soil and groundwater concentrations found in the source areas are strongly indicative of the presence of a dense non-aqueous phase liquid. Additional investigation is needed on the Crestwood Shopping Center and Crestwood Area Site properties to determine whether DNAPL is pooling at the base of the sand unit and potentially migrating from the properties. Our statewide modeling expert has assessed this issue and provided some useful comments (attached). We believe the next step is to develop an iso-contour map on the base of the sand unit, and compare this to existing data to help place specially designed monitor wells to attempt to locate pools of DNAPL. The results of this assessment should be used to evaluate the overall groundwater monitoring well layout and the remedial action proposal.

2. Natural attenuation assessment – The screened intervals for the wells used in the assessment need to be within the sand unit, preferably short screens at the base of the unit. Due to the presence of the filled-in quarry south of Silver Spring, we recognize that this sand unit may be missing or replaced in part by fill. Well screen intervals and lengths used in the assessment should, however, be similar.
3. Area south of Custer – This area will require better definition, in order to assess whether there is a risk to residences from vapor migration, and in order to achieve a final closure under the natural attenuation closure provisions. We have received a memorandum from the Department of Health and Family Services on this issue. A copy is attached.
4. Definition of dissolved phase plume – The investigation will need to be extended to better delineate the dissolved phase plume along the southwest boundary, specifically in the vicinity of the former Jung property south of Silver Spring.
5. Crestwood Shopping Center – Is it possible to obtain soil samples from beneath the former dry cleaner location, in order to determine whether a significant source of PCE exists in the vadose zone under the building? If this building is to remain, it may be necessary to have this information in order to assess the proposal for soil vapor extraction.
6. Utility migration assessment – Are you proposing to do any additional monitoring in the area of the sewer line to assess the need, if any, to address migration along the sewer line?

We hope these comments help you proceed on this project. I will be out of the office until September 22. In my absence, please contact my supervisor, Frank Schultz, 263-8694, regarding project review issues. Please contact Darsi Foss, WDNR Brownfields Section Chief, (608) 267-6713, to discuss or request feedback on whether Glendale meets the criteria for the municipal exemption to the spill statute.

Sincerely,

Pamela A. Mylotta
Hydrogeologist, Remediation & Redevelopment Program
SER

Enclosure: Memo from Resty Pelayo – WDNR to Pam Mylotta – WDNR, dated 8/26/99

c: Steve Keith – HNTB
Frank Schultz – WDNR
Darsi Foss –WDNR
Resty Pelayo – WDNR

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: August 26, 1999

TO: Pam Mylotta

FROM: Resty Pelayo, WDNR, RR/3, 608/267-3539 RMP

RE: Recommendations and review of HNTB Site Investigation reports dated March 1998 and May 1999 for the Crestwood Area Site submitted to the Glendale Community Development Authority, Glendale, WI

CC: Darsi Foss, RR/3; Dale Ziege, RR/3

SUMMARY

1.) For tetrachloroethylene (PCE), the generic soil saturation limit is about 235 mg/kg. Exceeding the soil saturation limit is an indirect indication that a non-aqueous phase liquid (NAPL) exists. This level has been exceeded from two (2) samples collected at the site. Considering that no results were reported from the presumed "source" area, finding downgradient samples with PCE levels exceeding the soil saturation limit is significant.

2.) Field lab vs. fixed lab results for same soil samples in the 1999 report show that field lab results are systematically biased low. For instance at GP-6 SS, the field lab result is 1 ppm PCE while the fixed lab reported 51 ppm in the soil sample. Thirteen (13) different boring locations had samples of soil/aquifer materials with PCE levels that are at least 20% of the soil saturation limit. These 13 borings do not include the borings with samples showing the 3 highest field lab results which were not confirmed by the fixed lab.

3.) Either report is not convincing that no NAPL exists. PCE DNAPL likely exists at the site. The highest PCE level in the groundwater samples was a field lab result of >64 mg/l. Considering the potential bias in field lab results and the water solubility of PCE (200 mg/l), this result further indicates the presence of a dense NAPL (DNAPL).

4.) The site monitoring wells (MWs), because of their design, may bias the results or miss the DNAPL (see Attachment). For instance, MW-3R, a water-table well with a 5-ft screen, had 2,600 ug/l PCE, while MW-3, a piezometer with a 10-ft screen, had detected only 410 ug/l. The MWs installed in 1997 wells were constructed with 10-ft screens below the water table (so technically, are piezometers). The MWs installed in 1999 are water-table wells screened in the sandy unit (except MW-14D which is a piezometer). The piezometers (1997 MWs and MW-14D) may serve as contaminant conduits. I recommend proper abandonment of these wells. I further recommend installing monitoring wells more suited to detect DNAPLs (see last figure in the Attachment). The detection, location and characterization of the DNAPL would dictate how best to proceed with a site remedy.

(3 pages to follow + 2-page attachment)

SOIL SATURATION LIMIT AND DNAPL

Commonly, the only convincing evidence of the presence of dense non-aqueous phase liquid (DNAPL) is the discovery of free product in a well. As indirect evidence, however, the US EPA had used the soil saturation limit. As defined in the US EPA Soil Screening Guidance (1996), the soil saturation limit is the contaminant concentration in soil at which the absorptive limits of the soil particles, the solubility limit of the soil-water, and the saturation of soil-vapor have been reached. For PCE, the generic soil saturation limit is about 235 mg/kg. [SSL generic assumptions: ρ_b (bulk soil density) = 1.5 g/cm^3; f_{oc} (fraction of organic carbon) =0.6%; θ_w (soil moisture content)= 0.15; n (total soil porosity)= 0.434; PCE solubility in water = 200 mg/l; PCE K_{oc} (organic carbon:water partitioning coefficient)= 155 ml/g; PCE H' (unitless Henry's law constant)= 0.75]

Two (2) samples have PCE levels higher than 235 mg/kg, thus indicating that a DNAPL is present at the site. Fourteen (14) soil/aquifer material analyzed from 13 different boring locations are at least 20% of the soil saturation limit (i.e., PCE in soil > 47 ppm).

Generally much lower soil concentrations were found in 1999 than in 1997. This may be due to several reasons. One, the difference may be an artifact of sampling and analytical technique as either protocol may have changed. DNAPLs are typically thin lenses, so a sample collected via a 2-ft cutting may yield lower results compared to a 0.5-ft cutting if both cuttings intercept the same thin NAPL lens. The 1998 report had a single depth (14' below ground surface) associated with the high 2,700 ppm PCE found.

The 1999 investigation relied on a field lab. However, the comparison of the field lab and fixed lab results for same soil samples in the 1999 report shows that field lab results were systematically biased low. For instance at GP-6 SS and GP-7 SS, the field lab results were 1 and 0.1 ppm PCE, respectively, while the corresponding fixed lab results were 51 and 5 ppm, respectively. Thirteen (13) different boring locations had samples of soil/aquifer materials with PCE levels that are at least 20% of the soil saturation limit. These 13 borings do not include the borings with samples showing the 3 highest field lab levels which were not confirmed by the fixed lab.

Two, the samples may have come from different depths, and because the DNAPL may be present in a very thin layer, a slight change in sampling depth may cause the difference in the contaminant levels.

Third, the DNAPL may be mobile such that the 1997 DNAPL location may be different from 1999. This third possibility would be the most problematic because hard-to-detect DNAPL pools may exist. From site data, the downward mobility of the DNAPL is apparently hampered by the presence of relatively low-hydraulic-conductivity clay unit beneath the fine-sand unit, so the NAPL may be following the topography of the top of the underlying clay unit.

There are "hints" from both reports that the reported samples were only peripheral to the "source"

area. No data from the source area (presumably in the Crestwood Mall) were included in either report, although cross-sections (e.g., Figure 5-6 in the 1998) had borings labeled with the prefix "CW" (CWGP-3 -4), perhaps collected nearer the mall. The reports posit that a possible transport mechanism may be due to the storm sewer diagonally bounding the site to the northeast. However, several samples removed (more than 100 ft away) from the storm sewer (e.g., BWGP-4, RWGP-5, GP-06 SS, GP-09 SS, GP-18 SS, GP-23 SS) have relatively high contaminant levels, and so are difficult to explain by this storm sewer scenario. These samples may indicate DNAPL at the site, and higher PCE levels detected down gradient of the source area suggests mobile DNAPL.

Soil PAHs and Direct Contact RCLs

Very few samples from the site were analyzed for PAHs. Table 4-2 of the 1999 HNTB report summarized the result. Table 4-2 also had a summary of HNTB's re-calculated PAH RCLs to reflect a 10^{-6} cancer risk and a target hazard quotient of 1. HNTB multiplied by 10 all the residential RCLs in DNR's PAH Interim Guidance (1997). Doing so overestimates the RCLs for non-carcinogens because to reflect a a target hazard quotient of 1, the residential non-carcinogen RCLs from DNR's PAH guidance should be multiplied by only a factor of 5 (not 10).

The above step is not necessary, however, especially if the objective is to determine the cumulative cancer risk contributed by the different PAHs. The cumulative cancer risk from the different PAHs can be determined using the equation below that can use either DNR's or HNTB's RCLs. To comply with NR 720.11(3), Wis. Adm. Code, the cumulative cancer risk may not exceed 1×10^{-5} such that:

$$\sum_{i}^{\text{All Carcinogens}} \frac{(\text{PAH Soil Level})_i}{(\text{DNR RCL})_i} \times 10^{-7} = \sum_{i}^{\text{All Carcinogens}} \frac{(\text{PAH Soil Level})_i}{(\text{HNTB RCL})_i} \times 10^{-6} \leq 1 \times 10^{-5}$$

Based on the data from the GP-1 SS sample provided in HNTB's table 4-2, I calculated the cumulative target hazard quotient to be less than 1, but the cumulative cancer risk at 8.1×10^{-5}, exceeding the allowed cancer risk for the protection from direct contact. This result is merely based on a single sample, so a better assessment (including collection of additional soil samples) may be necessary to better define the PAH contamination where GP-1 SS was collected.

GROUNDWATER

I have attached a general review of DNAPLs and how typical NR 141 water-table or piezometer monitoring well can easily miss the DNAPL. Briefly, the DNAPL can "escape" from the typical monitoring well. This may partly explain why the PCE levels from groundwater samples collected from geoprobe borings are much higher than the levels from monitoring well samples.

With the tendency of DNAPL to sink, the piezometers at the site that extend into the clay unit (below about 15') may serve as migration pathway for PCE DNAPL. I recommend that MW-14D (a piezometer) which extends deep into the underlying confining clay layer be properly abandoned because MW-14D is down gradient of the area where high contaminant levels were detected.

I would also recommend proper abandonment of the wells installed in 1997. Two wells (MW-3 and -4) of these 5 wells have already been abandoned. These 1997 wells are screened below the water table (technically piezometers) with a 10-ft screen. Note that NR 141.09(1) specifies only a 5-ft screen for piezometers. The 10-ft screen and the deeper sampling from these 1997 piezometers can bias the samples because longer screens can dilute contaminants in the monitoring well more so than in wells with shorter screens. For instance, "piezometer" MW-3 (10-ft screen from 18 to 28 ft depth) showed 410 ug/l PCE in 1997; however the replacement water-table well MW-3R (5-ft screen from 8 to 13 ft depth) showed 2,600 ug/l PCE (possibly greater as this result had a "J" or "estimated" analysis flag) in 1999.

I would recommend installing *at least* two (2) specially constructed monitoring wells. An NR 141 variance may be necessary to install such wells. The monitoring well would have a sump to be able to collect and detect DNAPL (see the 4th figure of the attachment). The best locations for these two wells may be near MW-3R and MW-5. The sumps on these monitoring wells should have the deflector at the top of the underlying clay and the cement sump extending into the underlying clay to have a better chance of collecting the DNAPL that probably may be located along the top of the clay.

SELECTED REFERENCES

U.S. EPA, *Soil Screening Guidance: Technical Background Document*, EPA/540/R-95/128, May 1996.

Wisconsin DNR, Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons (PAHs) - Interim Guidance, Publication RR-519-97, April 1997.

Attachment

8/26/99
A.M. Pelayo
WDNR
608/267-3539

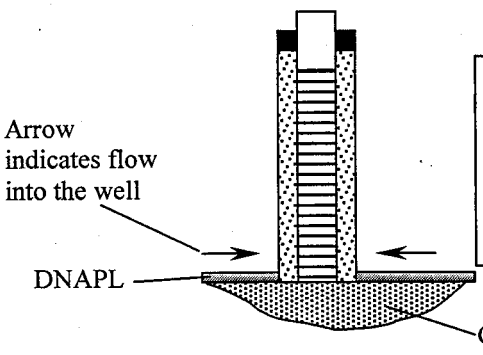
"Catching" DNAPLs

I. Introduction. DNAPL sites are commonly associated with certain industries, especially cleaners, metal fabricators and electronics manufacturing plants which use and store chlorinated solvents in their routine operations. DNAPLs or dense non-aqueous phase liquids are formed typically by chlorinated contaminants like tetrachloroethene/perchloroethylene (PCE), trichloroethylene (TCE), and 1,2-dichloroethane. These contaminants have densities greater than water and as such, are described as "sinkers" with their tendency to penetrate below the water table. Unlike lighter substances ("floaters" like gasoline compounds), the typical NR 141 water-table monitoring wells or piezometers may not provide adequate information in investigating and characterizing DNAPLs. DNAPLs have been described as difficult-to-detect, difficult-to-remove, long-term sources of groundwater contamination. US EPA (1993) statistics show that while 128 (40%) of 310 Superfund sites have chlorinated solvents, only 10% of these chlorinated sites had observed DNAPL. The Superfund DNAPL study inferred that many sites with no observed continuous DNAPL actually have either an immobile (residual) DNAPL or lenses of DNAPL missed by the available monitoring well network.

Currently, the only convincing evidence of the presence of DNAPL is the discovery of free product in a well. This can be expensive as there have been cases (e.g., DOE Savannah River Plant in Georgia) involving chlorinated solvents where DNAPL was found in a well but only after more than a hundred wells had been installed without finding DNAPL. This consideration and the nature of dense substances forming a NAPL necessitate a re-design of a monitoring well to "catch" these difficult-to-detect NAPLs.

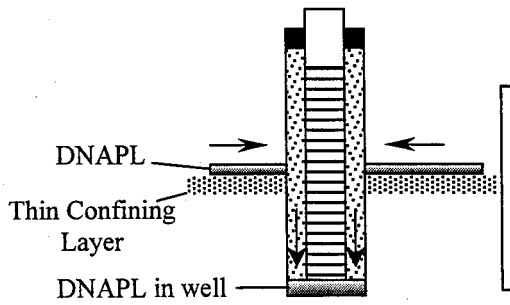
II. What mechanisms can lead to missing DNAPLs in monitoring wells? Following are figures with brief descriptions to illustrate how we can negatively bias (i.e., get low to no detection) our investigation of DNAPLs.

A.



This is generally a good placement for a well, but if DNAPL layers are thin and a fine sand pack used in the well, no DNAPL accumulates in the well. The DNAPL must be able to overcome the sand pack's capillary resistance to flow into the well.

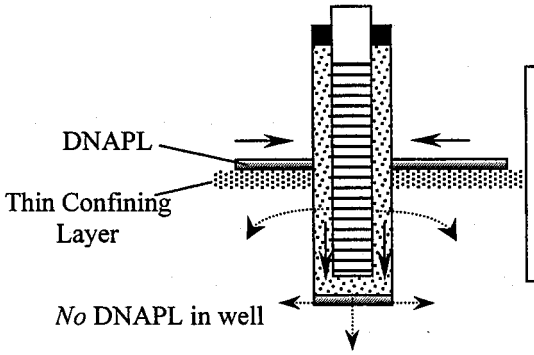
B.



The DNAPL from upper layers will sink to the bottom of our well and as a consequence, we can get erroneous depth and thickness of the DNAPL, or the DNAPL may be tied up by the fine sediments in the bottom of the well and not be detected.

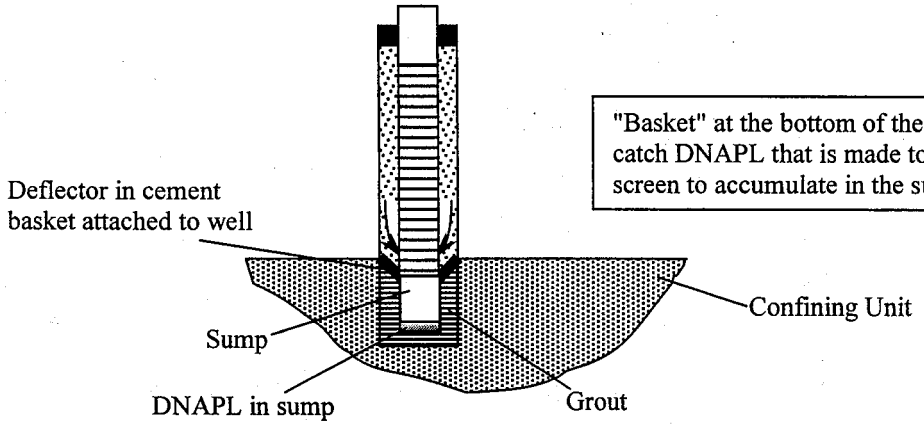
8/26/99
A.M. Pelayo
WDNR
608/267-3539

C.



The DNAPL may not accumulate sufficiently in, or may leak out of, the well; or the DNAPL may be tied up with the fine sediments in the bottom of the well. With the bottom of the well extending to another unit, cross-contamination between units may result.

III. So how can we improve our monitoring wells to reduce the bias from investigating DNAPLs? The figure below has been described as a "clever" device to catch DNAPL that sinks into the bottom of the well. The design involves a concrete sump for the DNAPL to accumulate, and the added construction of a deflector to allow NAPL entry into the sump. If the deflector can be placed at the top of a confining unit and the sump extended into the confining layer, we may get a better chance in catching DNAPL.



"Basket" at the bottom of the well is designed to catch DNAPL that is made to deflect into the well screen to accumulate in the sump.

IV. What other considerations are needed to investigate potential DNAPL sites? Aside from location of and special construction to allow entry of DNAPLs into monitoring wells, the thinness of DNAPL zones, clear-color of the contaminant and sampling protocol are other considerations at DNAPL sites. Several "indirect" methods can also be applied to determine the presence of DNAPL. Soil contaminant concentration reaching the predicted soil saturation limit, soil-gas samples reaching saturated vapor concentrations, and soil-water samples reaching effective solubility are all indicative of DNAPL.

V. References:

Cleary et al. (1996), The Princeton Remediation Course. Princeton Groundwater, Tampa, FL.

Niemeyer et al. (1993), Extraction well design for DNAPL recovery. In Proceedings of the 7th National Outdoor Action Conference and Exposition, May 25-27. National Groundwater Association, Dublin, OH, p. 193-206.

U.S. EPA (1993), Evaluation of the likelihood of DNAPL Presence at NPL Sites, National Results, EPA/540/R-93-073, Washington, DC.

CORRESPONDENCE/MEMORANDUM

STATE OF WISCONSIN
Division of Public Health
Bureau of Environmental Health
Health Hazard Evaluation Section
(608)-267-3732

DATE: August 31, 1999

TO: Pam Mylotta – DNR, Milwaukee

FROM: Chuck Warzecha CW

SUBJECT: Crestwood Redevelopment Project

I have reviewed the remedial action plan for the Crestwood site in Glendale. The existing information does not allow us to rule out indoor air quality as an exposure pathway in the residential area to the south. Additional investigation is needed to ensure that this pathway does not exist.

The investigations completed to date indicate that contaminated groundwater has migrated to an area beneath part of the residential neighborhood south-southeast of the contaminant source area. Although the contaminant concentrations are above drinking water standards, the water is not used as a drinking water source.

While in the area on Wednesday (8/25) I drove through this neighborhood. The homes are several decades old which would indicate a high potential for soil vapor intrusion through the basement foundations. In addition, the water table is not very deep in this area and the potential exists for basement sumps to intersect the water table in high water periods. Vinyl chloride is one of the contaminants of concern in the area of contamination and can drive a human health risk at relatively low concentrations in indoor air. In order to fully evaluate the potential for indoor air problems it may be necessary to contact individual homeowners within the extent of contamination.

For these reasons, I am recommending that additional investigation be done to characterize the degree and extent of contamination in groundwater and soil gas, as well as the potential for impact to indoor air quality in the residential area. I am willing to help you and the other parties involved develop an appropriate strategy for investigating this pathway. Unfortunately, modeling alone would not provide us with the confidence we would need to assure the residents they were protected. If an exposure pathway is identified active source control measures may be necessary.

Because the residential properties are within the city limits of Milwaukee, I also recommend that Terry Linder from the Milwaukee Health Department be involved in this discussion. If residents in this neighborhood have not already expressed concern about the contamination, the will likely do so in the future. It is important for us to be able to provide assurance that they are being protected when those concerns are raised.

Please call me at (608) 267-3732 if you have any questions about my recommendations or if I can be of further assistance. Thank you.

CC: Percy Mather
Terry Linder – City of Milwaukee Health Department