UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
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MEMORANDUM

SUBJECT: Evaluation of Potential Human Health Risks via the Groundwater to Indoor Air Vapor Intrusion Pathway at the Former Peoples Natural Gas Site
Dubuque, Iowa

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This memorandum evaluates the potential human health risks via the groundwater to indoor air vapor intrusion pathway at the Former Peoples Natural Gas site, located in Dubuque, Iowa. The site covers approximately 5 acres and is located approximately 500 feet west of the Mississippi River. Approximately 2,400 people live within a mile of the site and 21,000 people live within 3 miles. In previous investigations, volatile organic compounds, phenols, polycyclic aromatic hydrocarbons, and inorganic chemicals have been detected in groundwater at the site. Therefore, a screening level assessment was conducted to document the potential human health risks via the groundwater to indoor air vapor intrusion pathway. If you have any questions regarding this evaluation, please contact me at x7438.

Evaluation of Human Health Risks via the Groundwater to Indoor Air Vapor Intrusion Pathway at the Former Peoples Natural Gas Site

A screening level assessment was conducted to document the potential human health risks via the groundwater to indoor air vapor intrusion pathway. The U.S. Environmental Protection Agency guidance (USEPA, 1989) recommends that all risk assessments be based on the reasonable maximum exposure scenario. Therefore, for the assessment of the VI pathway, a residential scenario was assumed to represent the RME. It is assumed that the residential property is located over the most contaminated part of the plume.

The data used in this assessment are found in the *Amendment to the May 2006 Technical Impracticability Evaluation Report* (MWH, 2012) and summarized in Table 1. Also, the data used in this assessment were limited to the last two monitoring events (i.e., April and September 2011).

Exposure point concentrations, to be used in this screening level assessment, were determined using the EPA ProUCL statistical software package (USEPA, 2010) for those contaminants that had sufficient data (ProUCL requires a minimum of 8 to 10 data points). Only data from wells in which concentrations

exceeded the MCLs, or the Regional Screening Levels when MCLs were not available, were used in the calculation of the EPCs. For contaminants that did not have sufficient data to calculate an EPC using ProUCL, the EPC was determined by calculating the arithmetic mean. The EPCs, the method used to calculate the EPCs, and the monitoring well data that were used to calculate the EPCs are presented in Table 2.

The Vapor Intrusion Screening Level Calculator (USEPA, 2012a), developed by the Office of Superfund Remediation and Technology Innovation, was used to calculate the indoor air carcinogenic risks and non-carcinogenic hazards using groundwater EPCs presented in Table 2. The groundwater attenuation factor used in the spreadsheet calculations is 0.001, which is the generic attenuation factor recommended in the EPA's 2012 vapor intrusion database (USEPA, 2012b). An in situ groundwater temperature of 10°C was used, instead of the default value of 25°C, based on the average shallow groundwater temperatures in the United States (Collins, 1925).

The results of the screening level evaluation are summarized in Table 3. The estimated excess individual lifetime cancer risks for benzene, ethylbenzene, and naphthalene are greater than 1E-04, or 1 in 10,000. In addition, the non-cancer HQ is greater than 1 for benzene and naphthalene. Specifically, benzene presents the highest excess individual lifetime cancer risk of 5E-04, or 5 in 10,000, and naphthalene presents the highest non-cancer HQ of 5.5. These estimated risk values exceed the EPA's target cancer risk range of 1E-06 to 1E-04 and non-cancer HQ of 1. Based on this evaluation, contaminants in groundwater at the former Peoples Natural Gas site are at concentrations that may pose a significant health risk through vapor intrusion.

It is important to reiterate that this is a screening level evaluation based on a comparison of the EPCs with the residential air screening levels. In terms of uncertainty, the total excess individual lifetime cancer risk and non-cancer hazard quotients may be higher than presented in this screening level risk assessment because risk was only determined for individual contaminants. Total risk from exposure to multiple contaminants was not evaluated in this assessment because data from different wells were used to calculate the EPC for each contaminant (e.g., different wells were used to calculate the EPC for benzene than were used for naphthalene). As a result, an overestimation of potential health threat would likely occur if the cancer risk and hazard quotients from individual contaminants were added together.

Also, the arithmetic mean was used to determine EPCs for contaminants in circumstances when there were not enough data points to calculate UCLs using EPA's ProUCL software. As a result, it is possible that the arithmetic mean underestimates the excess individual lifetime cancer risk and hazard quotients. Finally, this evaluation assumes that chemical concentrations will remain constant over the entire 30 year exposure duration, which is unlikely to occur.

References

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U.S. EPA. 2010. ProUCL Version 4.1 User Guide (Draft). Office of Research and Development, Washington, D.C. EPA/600/R-07/041.

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U.S. EPA. 2012c. Regional Screening Level Table. April 2012. Available on-line at http://www.epa.gov/region09/superfund/prg/.

Table 1. Groundwater data collected from the silty sand aquifer. All data are in µg/L.

Monitoring Well	Sampling Date	Benzene	Ethylbenzene	Naphthalene
MCL		**5**	**700**	**NA**
RSL[1]		**0.39 c/29 n**	**1.3 c/670 n**	**0.14 c/6.1 n**
D-4	April 2011	*1,430*	*1,010*	*964 B*
	September 2011	*778*	673	*214 B*
D-6	April 2011	*659*	424	*538*
	September 2011	*1,600*	*709*	*2,610 B*
D-8	April 2011	*112*	25.2	*34.8 B*
	September 2011	*49.8*	20.7	*25 B*
P-112	April 2011	*454*	173	*6.63*
	September 2011	*151*	74.6	5.09 B
SE-2	April 2011	*99.6*	20.7	3.09 B
	September 2011	*112*	78.9	*96.6 B*
SS-6	April 2011	*2,800*	*1,610*	*3,930 B*
	September 2011	*2,720*	*1,480*	*4,080 B*
SS-8	April 2011	1.1	ND	1.8 B
	September 2011	*7.9*	1.8	2.5 B
SS-9	April 2011	*43*	2.1	*8.93 B*
	September 2011	*37*	1.9	*13.3 B*
W-118R	April 2011	*26.1*	ND	ND
	September 2011	*6.2*	ND	0.332 B
Wells Used in Calculation of EPC[2]		D-4, D-6, D-8, P-112, SE-2, SS-6, SS-8, SS-9, W-118R	D-4, D-6, SS-6	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-9
EPC		**1,426 (95% UCL)**	**984 (mean, n=6)**	**3,033 (95% UCL)**

Numbers in italics exceed the MCL or RSL

c – cancer: n - non-cancer; MCL - Maximum Contaminant Level; RSL – Regional Screening Level; EPC – Exposure Point Concentration

[1]Screening Levels are from the April 2012 Tapwater RSL Table (USEPA, 2012c).

[2]Wells that have concentrations greater than the MCL or RSL, when MCLs are not available, are used in calculating the exposure point concentration.

Table 2. Exposure Point Concentrations, methods used to calculate EPCs, and monitoring well data used to calculate the EPCs for the silty sand aquifer wells. All data are in µg/L.

Contaminant	RSL[1]		MCL	Wells Used in Calculating EPC[2]	EPC	Method to Calculate EPC
Benzene	0.39	c	5	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-8, SS-9, W-118R	1,426	95% UCL
Benzene	29	n	5	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-8, SS-9, W-118R	1,426	95% UCL
Ethylbenzene	1.3	c	700	D-4, D-6, SS-6	984	Arithmetic Mean (n=6)
Ethylbenzene	670	n	700	D-4, D-6, SS-6	984	Arithmetic Mean (n=6)
Naphthalene[3]	0.14	c	NA	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-9	3,033	95% UCL
Naphthalene[3]	6.1	n	NA	D-4, D-6, D-8, P-112, SE-2, SS-6, SS-9	3,033	95% UCL

c - cancer, n – non-cancer
MCL – maximum contaminant level
RSL – Regional Screening Level
[1]Screening Levels are from April 2012 Tapwater RSL Table (USEPA, 2012c).
[2]Wells that have concentrations greater than the MCL are used in calculating the EPC.
[3]An MCL is unavailable for naphthalene; therefore, wells that have concentrations greater than the RSL are used in calculating the EPC.

Table 3. Estimated cancer risks and hazard quotients at the former Peoples Natural Gas site.[1]

Contaminant	Groundwater EPC (µg/L)[2]	Calculated Indoor Air Concentration (µg/m^3)	Carcinogenic Risk	Hazard Quotient
Benzene	1426	156	5.0E-04	5.0
Ethylbenzene	984	128	1.3E-04	0.1
Naphthalene	3033	17.2	2.4E-04	5.5

[1]Indoor air concentrations, carcinogenic risk, and non-carcinogenic hazards were calculated using the Vapor Intrusion Screening Level Calculator (USEPA, 2012a).

[2]Exposure point concentrations are based on 95% upper confidence limits of the arithmetic mean. If insufficient data are available to calculate 95% UCLs, then arithmetic means were calculated. In general, only data from wells in which concentrations exceeded MCLs were used in the calculation of EPCs.