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Expert Report of Nadine Weinberg

Kathleen McHugh and Deanna Schneider et al. v. Madison-Kipp Corporation, et al.

United States District Court for the Western District of Wisconsin

Case No. 11-cv-724-bbc

January 21, 2013

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1. Introduction

This report summarizes my expert opinions and the bases for those opinions regarding the vapor intrusion pathway and the potential for an imminent and substantial endangerment to health or the environment from volatile organic compounds (VOCs) present on the Madison-Kipp property located at 201 Waubesa Street.

The opinions set forth in this report are presented to a reasonable degree of scientific certainty and are based on the following: a review of documents produced in this case by multiple parties that were provided by Michael Best & Friedrich LLP; my education; and my experience conducting vapor intrusion investigations and evaluating the data collected from these investigations. My opinions also rely on methods of analysis and investigation and equations that are generally accepted and are commonly used by regulatory agencies and risk assessors.

It should be noted that the compilation and review of documents is ongoing. Therefore, the information and opinions presented in this report may be modified as additional data or documents are reviewed. Appendix A includes a list of documents I have relied on and references from this report.

2. Expert Qualifications and Experience

I am currently a Principal Scientist/Associate Vice President of ARCADIS U.S., Inc. (ARCADIS), an environmental consulting firm headquartered in Highlands Ranch, Colorado. I have over 20 years of experience conducting risk assessment and risk-related work. I have been actively engaged in evaluating the vapor intrusion pathway since 2002. On behalf of clients, I have reviewed, conducted or overseen vapor intrusion assessments at hundreds of sites. Activities at these sites has included identification of strategic approaches to address vapor intrusion, modeling of the vapor intrusion pathway, development and design of sampling work plans, assessment of soil gas and indoor air data including the determination of potential human health risks, preparation of weight of evidence evaluations, and negotiations with regulatory agencies. I have also critically evaluated state standards developed for this pathway and compared the accuracy and effectiveness of the various monitoring, modeling, and mitigation strategies. Examples of my work in vapor intrusion have been presented at the Society of Risk Analysis and the Air and Waste Management Association conferences.

I am currently the National Vapor Intrusion Technical Lead for ARCADIS. In this role, I oversee the investigation of vapor intrusion and evaluation of vapor intrusion data nationwide and provide strategic analysis and recommendations on evaluating data related to the vapor intrusion pathway. I also am a senior leader of ARCADIS' Risk and Ecological Sciences group where I participate in and oversee the evaluation of human health risk assessments. My Curriculum Vitae is presented in Appendix B along with a list of publications and presentations I have authored in the last 10 years and a list of cases for which I have provided expert testimony at trial or deposition within the past four years.

I have a Bachelor of Science degree in Natural Resources from Cornell University and a Masters in Environmental Management in Resource Ecology from Duke University. I received my Bachelor of Science in 1989 and my Masters in Environmental Management in 1993. From 1989 until 1993 I was employed by the U.S. Environmental Protection Agency (USEPA). From 1989 to 1991, I worked in the Office of Emergency Response and Solid Waste addressing issues under the National Contingency Plan related to State and Federal funding and allocation issues. From 1991 to 1993, I worked in the Office of Air Quality Planning and Standards on issues related to evaluation and emissions of hazardous air pollutants. Prior to joining ARCADIS in 1998, I worked at ChemRisk from 1993 to 1998. ChemRisk is an environmental consulting firm that specializes in the evaluation of human and ecological risks from chemicals in the environment.

3. Expert Opinions and Basis

The following is a listing of my expert opinions and supporting bases in this matter relating to the vapor intrusion pathway.

3.1. Opinion 1

The vapor intrusion (VI) pathway only recently became a required part of remedial activities.

Summary of Bases of Opinion

Summary of VI Regulatory History

USEPA defines vapor intrusion as the migration of volatile chemicals present in subsurface soils or groundwater into the indoor air spaces of overlying buildings through openings (i.e., cracks) in the building foundation (USEPA 2012a). A chemical is broadly defined as volatile if its Henry's Law Constant (HLC) is greater than 1 x 10^{-5} atmospheres per meter cubed per mole (atm-m^3/mol) or its molecular weight is less than 200 grams per mole (g/mole) and its vapor pressure is greater than 1 millimeter of mercury (mm Hg) (USEPA 2012a). Based on these criteria, Aroclor 1242, 1248, 1254 and 1260 (PCBs detected on-site and off-site) would not be considered volatile due to a molecular weight greater than 200 g/mole and a vapor pressure greater than 1 mm Hg (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/params_sl_table_run_NOV2012.pdf, ATSDR 2000). Similarly, PAHs would not be considered volatile chemicals based on these criteria. Benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(ah)anthracene, fluoranthene, and indeno(123-cd)pyrene would be eliminated as they all have a HLC less than 1 x 10^{-5} atm-m^3/mol. Benzo(a)anthracene, benzo(ghi)perylene, phenanthrene, and pyrene would not be considered volatile based on their molecular weight and vapor pressure http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/params_sl_table_run_NOV2012.pdf, ATSDR 1995). Based on USEPA (2002) and more recent state and USEPA documents (i.e., ITRC 2007), when a volatile chemical is present in soil or groundwater within 100 feet of an occupied building, the vapor intrusion pathway should be investigated.

Vapor migration in the subsurface is influenced by several fate and transport mechanisms such as chemical-specific properties, soil type, soil moisture content, weather conditions including rainfall and barometric pressure, and building construction. In addition, vapors typically move from areas of higher to lower concentration and from areas of higher to lower pressure (USEPA 2012a). In general, this means that vapors in soil or groundwater will generally move up through the soil pore spaces toward a building or if no building is present disperse into ambient air.

Given the known mechanisms of vapor transport in the subsurface, volatile organic chemicals (VOCs) present in shallow soil at a depth less than the building foundation have no pathway to migrate downward under buildings. As a result, shallow soil cannot be a source of vapors under homes. Instead, VOCs in shallow soil will quickly migrate up through the soil column into ambient air, where those vapors are quickly diluted into the atmosphere (ITRC 2007, USEPA 2012b).

Data have shown that as vapors move from dissolved groundwater to exterior soil gas, sub-slab soil gas, and/or indoor air they will decrease in concentration (USEPA 2002, ITRC 2007). The reduction in vapor concentration between the subsurface source and indoor air is defined as the attenuation factor (AF) (USEPA 2012c). The AF is calculated as the ratio of indoor air to soil gas, sub-slab soil gas or groundwater. USEPA and other regulatory agencies use AFs to calculate screening levels for sub-slab soil gas, soil gas and groundwater from conservative indoor air screening levels, or conversely, to estimate indoor air concentrations from these same subsurface media.

At the time that the Madison Kipp site was first identified in 1994, vapor intrusion was not regularly, or even occasionally, addressed at sites undergoing environmental investigation. From 1993 to 1998, I worked conducting human health and ecological risk assessments at a wide variety of environmental sites. At several sites, the risk assessment did evaluate the migration of either VOCs or metal particles into ambient (i.e., outside) air (USEPA 1989). However, in not a single case, did the risk assessment ever consider the migration of VOCs in soil gas and into overlying or nearby homes or structures.

Although a few scientific papers had been published (Johnson and Ettinger 1991, ASTM 1994), in the 1990s the regulatory community was not rapidly moving toward a realization of vapor intrusion. The only two documents published by USEPA (1992, 1993) are described by Folkes and Arell (2003) as “obscure” documents that did not lead to the inclusion of the vapor intrusion pathway in any remedial investigations. In 2003, Folkes and Arell conclude that “the science of vapor intrusion is still in its infancy and regulators are still being trained in the application of the proposed Office of Solid Waste and Emergency Response (OSWER) guidance. Very little information is available in the technical literature” (page 9). Plaintiff expert Dr. Lorne Everett’s own paper supports this finding. Dr. Everett states “…for the majority of contaminant releases, the vapor intrusion pathway often was not considered or typically was not given as much attention as the groundwater transport pathway. While many fine [vapor intrusion] exceptions exist, until very recently, the emphasis on groundwater monitoring has dominated the environmental assessment and remediation industry” (Kram et al. 2011, page 60).

In November 2002, USEPA released the OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). USEPA (2002) recommends a step-wise approach that includes three tiers; primary screening, secondary screening, and site-specific pathway assessment. The primary screening allows for the evaluation of the vapor intrusion pathway based on groundwater or soil gas data alone. In the secondary screening, information on depth to groundwater or soil gas and soil type are added into the screening process. Additional data collection, including sub-slab soil gas and indoor air sampling, is only recommended in the site-specific pathway assessment (i.e., the third tier), after the exterior soil gas pathway has been fully evaluated.

Based on my experience, the release of the USEPA (2002) Draft Subsurface Vapor Intrusion Guidance did lead to greater inclusion of the vapor intrusion pathway in remedial investigations. Prior to this time, however, investigation of the vapor intrusion pathway was not considered nor understood by most regulatory agencies to be a significant exposure pathway of concern.

After the publication of the Draft Subsurface Vapor Intrusion Guidance, USEPA continued its research on the vapor intrusion pathway and published additional guidance documents on the topic (USEPA 2003, USEPA 2004, USEPA 2005, USEPA 2006a,b). This research is on-going as USEPA continues to learn more about the vapor intrusion pathway (USEPA 2011, 2012a,b,c,e). In January 2007, the Interstate Technology and Regulatory Council (ITRC) published Technical and Regulatory Guidance entitled Vapor Intrusion Pathway: A Practical Guide. This guidance was developed by State regulatory agencies as a “guidebook” to developing vapor intrusion investigative and evaluation methods.

In January 2007 (three years after Madison Kipp had initiated its vapor intrusion investigation), I participated in a breakfast seminar on vapor intrusion with Ms. Theresa Evanson. I understood Ms. Evanson to have been then and to still be now, the Wisconsin Department of Natural Resources (WDNR’s) expert lead on the vapor intrusion pathway. At the time, WDNR did not have a vapor intrusion policy or guidance. Instead, Ms. Evanson indicated that the state was working on guidance that would provide for a step-wise and focused assessment of the pathway starting with an on-site evaluation. Moreover, Ms. Evanson indicated that evaluation of the vapor intrusion pathway at off-site properties was just beginning.

In December 2010, WDNR published vapor intrusion guidance titled “Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin” (WDNR 2010a). This was the first time WDNR published specific guidance on addressing the vapor intrusion pathway in its entirety. The WDNR guidance recommends a step-wise approach for evaluating vapor intrusion starting with on-property sources and moving out to those buildings closest to the identified sources. In the case of chlorinated volatile organic compounds (CVOCs) in groundwater, the guidance specifically recommends starting with a soil vapor survey to identify the extent of subsurface vapor movement and to identify those buildings that may need further assessment.

If sub-slab and indoor air data are collected, WDNR (2010a) indicates that "prior to indoor air sampling, conduct a survey for any items that may contribute VOCs to the indoor air and remove those items from the building at least 24 hours prior to sampling" (page 12). In the absence of these data, interpretation of the indoor air data is significantly compromised as it is not possible to determine if products used or brought into a building are contributing to indoor air detections.

The WDNR vapor intrusion guidance also identifies Vapor Action Levels and Vapor Risk Screening Levels. A Vapor Action Level is defined as the indoor air concentration that corresponds to a cancer risk of 1×10^{-5} or a noncancer hazard of 1. In contrast, the Vapor Risk Screening Level is defined as the soil gas, sub-slab soil gas, or groundwater concentration that is protective of indoor air at the risk levels identified above. The Vapor Risk Screening Level is calculated using AFs. As noted above, the AF is the ratio of indoor air to soil gas or groundwater and describes the decrease in concentration moving from a subsurface concentration to indoor air. WDNR (2010a) guidance defines the following AFs: 0.1 (sub-slab soil gas); 0.1 (shallow soil gas [less than 5 ft below foundation]); 0.01 (deep soil gas [greater than 5 ft below foundation]); 0.001 (groundwater).

For tetrachloroethene (PCE), the Vapor Action Level prior to February 2012 was 4.1 micrograms per cubic meter (µg/m^3) or 0.6 parts per billion by volume (ppbv) for a residential exposure scenario (i.e. indoor air). USEPA completed a final Toxicological Assessment for Tetrachloroethylene (Perchloroethylene) in February 2012 (USEPA 2012d). The PCE Vapor Action Level changed to 42 µg/m^3 or 6.2 ppbv based on this final assessment (USEPA 2012d). Using the AFs defined by the WDNR (2010a), yields PCE Vapor Risk Screening Levels sub-slab soil gas of 41 µg/m^3 or 6 ppbv prior to February 2012 and 420 µg/m^3 or 62 ppbv after February 2012 (http://dnr.wi.gov/topic/Brownfields/documents/vapor/vapor-quick.pdf). It should be noted that the calculation of the PCE Vapor Risk Screening Level for sub-slab soil gas is based on using a conservative AF of 0.1 (i.e., the sub-slab soil gas concentration can be 10 times greater than the indoor air Action Level). USEPA (2012c) recently provided a more robust analysis of AF data for sub-slab to indoor air and determined that a value of 0.03 was representative and protective of 95% of homes. Using an AF of 0.03 results in a PCE Vapor Risk Screening Level of 1,400 µg/m^3 or 207 ppbv for sub-slab soil gas. In my opinion and based on my review of sub-slab soil gas and indoor air data from hundreds of homes, the Vapor Risk Screening Level using an AF of 0.03 is more appropriate and adequately protective of residential homes.

The conservative calculations used for both Action Levels (indoor air) and Vapor Risk Screening Levels (sub-slab soil gas) for PCE confirm that any detection of PCE in sub-slab soil gas or indoor air above “non-detect” is not sufficient grounds to require on-going monitoring or to determine that the vapor intrusion pathway is complete. The Vapor Action Level and Vapor Risk Screening Levels are used to evaluate the results of data related to the vapor intrusion pathway. WDNR guidance indicates that when a vapor sample exceeds a Vapor Action Level or a Vapor Risk Screening Level, it cannot be automatically concluded that vapor intrusion is occurring. Additional sub-slab soil gas or indoor air sampling may be conducted, especially if the Vapor Action Level is not exceeded. In addition, other lines of evidence (i.e. building construction, source location and strength, presence of background sources) or information need to be considered to fully understand the vapor intrusion pathway (WDNR 2010a). In my opinion and as supported by WDNR (2010a) guidance, if the Vapor Risk Screening Level is not exceeded, then there is no risk to human health from vapor intrusion.

Chronology of Events

The vapor intrusion pathway was first identified as a potential pathway at the Madison Kipp site by the Wisconsin Department of Health and Family Services (WDHFS) in 2003. Investigation of the vapor intrusion pathway appears to be prompted by an Agency for Toxic Substances Disease Registry (ATSDR 2003) Health Consultation conducted in conjunction with the WDHFS. The public health assessment concluded that the vapor migration potential at the Madison Kipp site was an “indeterminate public health hazard.” As a result, a soil gas investigation on the Madison Kipp property was recommended to determine whether vapors were migrating toward nearby homes.

Henry Nehls-Lowe (WDHFS) provided a summary of the ATSDR Health Consultation to Constantine Tsoris, WDNR, in a September 29, 2003 letter (WDHSF 2003). The September 29, 2003 letter indicates that VOCs in soil on the Madison Kipp property could possibly be a source of soil gas and recommends soil gas testing at the property boundary. Groundwater was specifically not identified as a source, as only low detections of VOCs were identified in shallow groundwater and the groundwater flow direction was indicated to be to the south-southwest, side-gradient to residential homes (URS 2002). Soil gas investigation was recommended as the first step consistent with USEPA (2002) Draft Subsurface Vapor Intrusion Guidance. Indoor air sampling was specifically not recommended based on the Health Consultation.

Investigation of the vapor intrusion pathway was first requested of Madison Kipp in a May 7, 2004 memo from Constantine Tsoris, WDNR, to Mr. Mark Meunier, Madison

Kipp. As previously stated, prior to this time period, it was not standard practice to investigate vapor intrusion as a pathway of concern. In the absence of WDNR vapor intrusion guidance, USEPA (2002) recommendations for vapor intrusion investigations were followed at the Site. Based on the available data and the recommendations from WDHSF, Division of Public Health, the appropriate next step was identified as soil gas sampling at the property boundary near the source area.

Consistent with the May 7, 2004 request from WDNR, in June 2004, Madison Kipp agreed to install soil vapor probes and collect soil vapor data (RSV 2004). A plan to install the soil vapor wells was approved by the WDNR in a July 2004 letter (WDNR 2004). Soil vapor wells were installed in December 2004 and sampled in February 2005 consistent with WDNRs request. Data results were provided to WDNR in March 2005 with a recommendation to continue sampling soil vapor probes quarterly for the next year. Madison Kipp conducted the quarterly soil vapor sampling as required by WDNR.

At the end of the year long sampling period, the data were provided to WNDR and soil vapor sampling near residential homes closest to the on-site source area was requested (WDNR 2006). Soil vapor probes were installed in the backyards of 150, 154, and 162 South Marquette Street, closest to the on-site soil vapor probes. All soil gas wells were sampled quarterly from October 2006 to September 2009 under the direction of the WDNR (WDNR 2009a).

In July 2009, WDNR vapor intrusion coordinator (Theresa Evanson) acknowledged that collection of another round of soil vapor samples was appropriate and necessary prior to determining whether sub-slab soil vapor sampling was necessary (WDNR 2009b). This conversation with WDNR continued through 2010 (WDNR 2010b). Although several options were considered, WDNR did not specifically request sub-slab soil gas sampling in any homes until April 2010 (WDNR 2010b). Again, prior to this request, Madison Kipp had been following an approved plan for quarterly sampling of on- and off-site soil vapor probes. WDNR continued to monitor results from the soil vapor probes, but did not request sub-slab sampling until 2010.

In August and September 2010, Madison Kipp contacted the homeowners at 150, 154 and 162 South Marquette Street to obtain access for sub-slab soil gas sampling. Sub-slab soil gas samples were collected from all three homes in November 2010 (Nauta 2010). In February 2011, sub-slab soil gas and indoor air samples were collected from these three homes previously sampled for soil gas (WDNR 2011a). WDNR was present for this sampling to observe the sampling procedures given that they had not previously used or seen the helium shroud technique for confirming probe installation.

Based on the sub-slab and indoor air data results, sub-slab depressurization systems were installed in all three homes as a precautionary measure. PCE was not detected in indoor air in two out of the three homes (WDNR 2011a). In both these homes, the data only indicated the potential for vapor intrusion. Per WDNR (2010a) guidance, further assessment of the vapor intrusion pathway would have been an appropriate next step. Madison Kipp also installed mitigation systems at 146 and 166 South Marquette Street, the two properties to the north and south of the three homes as a conservative measure.

A more extensive soil gas survey was conducted around the Madison Kipp property boundary in 2011 (WDNR 2011b). These data results confirmed that many of the soil vapor samples were below the Vapor Risk Screening Levels for PCE, conservatively assumed to be 60 ppbv (WDNR 2010a). The highest concentrations were, as expected, near groundwater wells MW-3 and MW-5 and the two identified source areas.

After February 2011, Madison Kipp spent several months discussing with WDNR additional vapor intrusion sampling near and in residential homes. Over the course of several months, WDNR requests changed significantly, such that progress towards additional sampling was significantly slowed. Sampling in additional residential homes was initiated in early 2012 once agreement on the scope of work was obtained. In my experience, at a regulated site, the party conducting the investigation must obtain regulatory approval prior to proceeding with investigative work.

3.2. Opinion 2

Madison Kipp followed the applicable standard of care for obtaining and evaluating data related to the vapor intrusion pathway.

Summary of Bases of Opinion

It is my opinion to a reasonable degree of scientific certainty that Madison Kipp has followed standard and accepted practices for investigating and evaluating the vapor intrusion pathway and thus has met the applicable standard of care. Throughout the investigation of the vapor intrusion pathway, Madison Kipp followed a standard and recommended approach for investigating the vapor intrusion pathway (USEPA 2002).

The vapor intrusion investigation and evaluation plan carried out by Madison Kipp was consistent with the regulatory guidance and current understanding (or lack thereof) of vapor intrusion at the time the investigation was conducted. After initiating a vapor intrusion investigation, Madison Kipp appropriately conducted a step-wise sampling program following standard sampling and analytical procedures for that period. This program was carried out under the direction and oversight of the WDNR, despite the lack of any regulatory guidance or standard protocols to guide the investigation and evaluation process throughout much of the sampling and data analysis.

In July 1994, Madison Kipp was first notified of the potential for tetrachloroethylene (PCE) to be present in groundwater and was requested to determine the horizontal and vertical extent of the contamination (WDNR 1994). With respect to the vapor intrusion pathway, the request by WDNR (1994) does not identify nor discuss any investigation needed to evaluate vapor intrusion. At the time of the request in 1994, vapor intrusion was not regularly, or even occasionally, addressed at sites undergoing environmental investigation.

Investigation of the vapor intrusion pathway was first identified as a potential pathway of concern for the Madison Kipp Site by the WDHFS in 2003 and sampling was requested by WDNR and initiated by Madison Kipp in 2004 following the publication of USEPA's (2002) Draft Subsurface Vapor Intrusion Guidance. Prior to this time period, it was not standard practice to investigate vapor intrusion (see Opinion 1). Once vapor intrusion was identified as a potential migration pathway, Madison Kipp followed standard and accepted procedures in coordination with WDNR, as documented previously.

In the absence of WDNR vapor intrusion guidance, USEPA (2002) recommendations for vapor intrusion investigations were followed at the Site. This was identified as soil gas sampling at the property boundary. When soil gas data indicated that PCE was present in on-site soil gas, additional off-site sampling was requested by WDNR and collected by Madison Kipp. Indeed, at the time of the start of this investigation, soil gas was seen as the primary investigative tool for understanding vapor intrusion. Even in guidance relied upon today, soil gas investigation is often viewed as the starting point for a vapor intrusion investigation.

By the time WDNR released vapor intrusion guidance in 2010, Madison Kipp had been conducting a vapor intrusion investigation at the site for six years including collecting multiple rounds of on-site and off-site soil gas sampling. These data results had been provided to WDNR on a regular basis (RSV 2007, 2009) and had shown that PCE concentrations in soil gas declined dramatically moving from on-site to off-site areas.

Finally, when sub-slab soil gas and indoor air data were requested by WDNR based on the soil gas data in residential yards, Madison-Kipp worked with homeowners to obtain access and conduct the sampling. As a precautionary step, Madison-Kipp installed mitigation systems in three homes (150, 154, and 162 South Marquette Street) to address the PCE concentrations detected and installed two mitigation systems in the neighboring homes (146 and 166 South Marquette) as well.

3.3. Opinion 3

The vapor intrusion pathway is incomplete at off-site properties.

Summary of Bases of Opinion

WDNR (2010a) guidance for vapor intrusion states that "measured vapor concentrations in the sub-slab that are less than the applicable screening levels (considering the appropriate risk exposure and AF) indicate there is not a risk to human health due to vapor intrusion. In this scenario, the vapor intrusion pathway will be considered adequately addressed" (page 15).

The WDNR Vapor Risk Screening Level for PCE in sub-slab soil gas is 62 ppbv (WDNR 2012). With the exception of the 2011 samples taken at 162, 154, and 150 South Marquette Street, all sub-slab soil gas concentrations for PCE are well below the Vapor Risk Screening Levels (Figure 1). At the three homes listed above, sub-slab soil gas concentrations exceeded 60 ppb in sampling conducted in 2011 and sub-slab depressurization systems (SSDS) were installed by Madison Kipp. In addition, all indoor air concentrations for PCE were below the Action Level of 6.2 ppbv, including the results from the homes at 162, 154, and 150 South Marquette Street (Figure 2). Although PCE has not been detected in indoor air above the Action Level of 6.2 ppbv, prior to February 2012, there was one indoor air concentrations at 154 South Marquette that exceeded the Action Level of 0.6 ppbv (detection was 0.67 ppbv)[1].

[1] A SSDS was installed in 154 South Marquette Street in 2011.

The WDNR Vapor Risk Screening Level for trichloroethylene (TCE) is 3.8 ppbv using an AF of 0.1 to convert from the indoor air Action Level of 0.38 ppbv. Figure 3 presents the sub-slab soil gas data results from all homes sampled within the Class Area. TCE was not detected in sub-slab soil gas above the Vapor Risk Screening Level from any homes sampled including 162, 154, and 150 South Marquette Street. TCE was also not detected above the Action Level of 0.38 ppbv in any indoor air sample.

The data collected in the Class Area confirm that the vapor intrusion pathway is not complete. Both PCE and TCE have never been detected in indoor air above their respective Action Level. Moreover, sub-slab soil gas data confirm that there is not a source of PCE or TCE vapors under the houses (except potentially PCE at 162, 154, 150 S. Marquette, in the past) that could lead to a complete pathway either now or in the future. Simply put, PCE and TCE are not present in sub-slab soil gas at levels that could be of concern for vapor intrusion.

Moreover, as of the report's writing, a total of 18 homes have received in home mitigation systems as a precautionary measure, as addressed more fully below.

Sufficient sub-slab soil gas and indoor air data are available to make a determination regarding the vapor intrusion pathway.

The sub-slab soil gas and indoor air data results confirm that the vapor intrusion pathway is incomplete at all homes within the Class Area, with the historical exceptions noted above. In total, 27 homes were sampled in the Class Area and most homes were sampled two or more times. This yields over 100 data points by which vapor intrusion may be evaluated. My review of these data points indicates that not only is the vapor intrusion pathway incomplete, but that the extent of PCE in soil gas has been defined. No further investigation of vapor intrusion is needed.

As stated above, PCE and TCE in sub-slab soil gas are less than Vapor Risk Screening Levels at all homes within the Class Area with the historical exception of PCE at 150, 154, and 162 South Marquette Street. Under these conditions and per WDNR (2010a) guidance, the vapor intrusion pathway has been adequately addressed and no further investigation is necessary. WDNR (2010a) guidance clearly states that concentrations need to be less than the Vapor Risk Screening Levels; there is no indication or statement that the concentrations need to be (ND) non-detect. Indeed, it is my experience and as supported by USEPA guidance that VOCs are often detected in low levels in sub-slab soil gas as chemicals are used by many households as part of daily living (USEPA 2011a). USEPA (2011a) readily acknowledges that PCE and TCE is a background constituent that is often detected in residential homes. PCE background concentrations at the 90th percentile range from ND to 7 µg/m^3 or 1.03 ppbv. TCE background concentrations at the 90th percentile range from ND to 2.1 µg/m^3 or 0.39 ppbv. As a result, any detection of PCE (or TCE) in sub-slab soil gas (or indoor air) is not sufficient grounds to expand the vapor intrusion investigation beyond the Class Area (WDNR 2010a).

Within the Class Area (and excluding the three homes identified above), sub-slab soil gas concentrations for PCE ranged from ND (<0.15 ppbv) to 17 ppbv (Figure 4). Of the detected concentrations, PCE ranged from 0.18 to 17 ppbv, over 59 different sample points. These data results were collected over an extended time period, from March 2012 through November 2012. Therefore, not only are the data below Vapor Risk Screening Levels, but sufficient data points are available both temporally and spatially to allow for a full assessment. Based on my experience, often far less data are collected at sites to evaluate the vapor intrusion risk potential. The extensive data collection from this site clearly demonstrate that PCE is not currently migrating off of the Madison-Kipp property and under residential homes at unacceptable levels.

A similar finding can be made for indoor air. An extensive database of results is available by which a decision regarding vapor intrusion can easily be made. Indoor air concentrations for PCE ranged from ND (<0.035 ppbv) to 5.88 ppbv over 62 different sample points. In 52% of the homes sampled, PCE was not detected in indoor air at any level. In the 13 homes where PCE was detected, concentrations detected are significantly less than Action Levels. Even at these homes, the low sub-slab soil gas concentrations confirm that the vapor intrusion pathway is incomplete. For homes where PCE was not detected in indoor air, the evidence is more than clear. Where sub-slab soil gas is less than Vapor Risk Screening Levels and indoor air is ND for PCE, there is no possibility that vapor intrusion is occurring.

Again, sufficient data have been collected over time and at all homes to allow for a complete determination of the vapor intrusion pathway.

All sub-slab soil gas and indoor air results are less than acceptable screening levels.

The extensive sub-slab soil gas data collected at residential homes surrounding the Madison-Kipp facility confirm that PCE is not migrating under homes at unacceptable concentrations. With the exception of the three homes located directly across from the

MW-5 well cluster (i.e., 150, 154, and 162 South Marquette), PCE has never been detected above levels that would require mitigation or regulatory action.

In February 2012, USEPA finalized its Toxicological Review of Tetrachloroethylene (Perchloroethylene) and revised both the inhalation reference concentration (RfC) for noncancer health effects and the inhalation unit risk estimate (UR) for cancer health effects. As a result of the promulgation of USEPA's final report, WDNR recalculated the residential Action Level for PCE at 6.2 ppbv for indoor air (based on a noncancer hazard of 1) and the Vapor Risk Screening Levels for sub-slab soil gas at 62 ppbv (WDHFS 2012). All sub-slab soil gas and indoor air data are compared to these health-based screening levels developed by WDNR as these values represent the most current data on the toxicity of PCE. As presented previously, the Vapor Risk Screening Levels is calculated using an AF of 0.1. Using an AF of 0.03 results in a PCE Vapor Risk Screening Level of 207 ppbv. Based on my experience, it is my opinion that detection of PCE below relevant screening levels is sufficient evidence to confirm that the vapor intrusion pathway is incomplete.

Figure 1 shows the sub-slab soil gas data results compared to the Vapor Risk Screening Level of 62 ppbv. With the exception of the three homes previously identified, there were no detections above the Vapor Risk Screening Level in sub-slab soil gas. Indeed, most of the homes had sub-slab detections at less than 6 ppbv – 10 times below the WDNR Vapor Risk Screening Level.

Figure 2 presents the indoor air data results compared to the Action Level of 6.2 ppbv. There were no detections above this Action Level in indoor air. Indeed, with the exception of one home (154 South Marquette), all indoor air detections were less than 10 times the WDNR Action Level (i.e., less than 0.6 ppbv) and well below the USEPA (2011a) Indoor Air Background Concentrations for PCE at the 50th percentile (i.e., 4.1 µg/m3 or 0.69 ppbv). At 249 Waubesa, PCE was detected in indoor air in one out of four samples. The one detection was less than the Action Level, but was greater than 0.6 ppbv and is not considered representative of indoor air concentrations given the other data results including recent sampling conducted on January 11, 2013 (Eurofins 2013). In addition, WDNR (2012) indicated that this home had a basement drain system installed by the home owner that might have affected the indoor air results. In other words, the concentrations detected in all but one of the Class Area homes were less than the average concentration detected in the homes included in the many studies evaluated as part of USEPA's indoor background study.

It should be noted that despite a recommendation from the Department of Health (WDHFS 2012), WDNR chose to use "project-specific vapor screening levels" based on outdated technical data on the toxicity of PCE. Although these values are only used to determine if mitigation is necessary, not if vapor intrusion is occurring, they provide a false indication to residents that a lower level is necessary to protect against vapor intrusion. In my opinion, there is no technical basis for using the lower value to evaluate vapor intrusion.

Concentrations detected in sub-slab soil gas and indoor air are consistent with background.

Indoor air data collected from all homes within the Class Area are consistent with typical background levels for PCE (USEPA 2011a). Indoor air concentrations within the Class Area ranged from ND to 5.88 ppbv, although the 5.88 ppbv is likely an outlier due to site-specific conditions at this home (i.e., 249 Waubesa)[2]. The next highest indoor air concentrations were 1.31 ppbv and 0.52 ppbv. As identified below, these PCE concentrations are consistent with those found in typical residences throughout the United States.

USEPA (2011a) evaluated 13 studies with background data on PCE from residences not located near or affected by environmental remediation sites. At these homes, PCE background concentrations in indoor air ranged from ND to 660 µg/m^3 or 88.45 ppbv. The 75th percentile background range is reported to be ND to 4.1 µg/m^3 or 0.604 ppbv. These results were confirmed in a recent study at 50 non-smoking residences in Montana (Cote and Martich 2012) that found PCE at concentrations ranging from 0.061 µg/m^3 (0.009 ppbv) at the 25th percentile to 2.8 µg/m^3 (0.41 ppbv) at the 95th percentile. In particular, PCE is identified in this study as having common indoor and ambient sources. Moreover, the evaluation of background further calls into question the use of 0.6 ppbv as a screening for the determination of vapor intrusion. The data on PCE document that such levels could be and are likely found in any home in the U.S.

WDNR's articulated approach (see Schmoller Exhibit 29), therefore, to use between ND and 6 ppbv as the concentration to determine whether a mitigation system will be installed is not scientifically supported, is technically unjustified, and is unprecedented

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[2] Additional sampling at 249 Waubesa has confirmed that PCE is ND in indoor air (Eurofins 2013).

in my experience. In effect, WDNR is using background PCE concentrations and even no detection of PCE to make a determination for installing mitigation. This approach is not only unprecedented, it violates WDNR's own guidance (WDNR 2010a).

Given the concern for background sources to influence indoor air concentrations, USEPA recommends the implementation of a weight of evidence approach to evaluate the potential for vapor intrusion. USEPA (2012a) acknowledges that the evaluation of vapor intrusion is complicated by the presence of background concentrations including consumer and other products that release VOCs into indoor air. One of the lines of evidence typically used in vapor intrusion assessments to distinguish background is the evaluation of AFs. USEPA (2012a) specifically recommends the comparison of the relative proportions of chemicals in indoor air to that detected in sub-slab soil gas to determine if the results are likely due to vapor intrusion or are more likely associated with background. USEPA (2012a) Frequently Asked Questions identifies a sub-slab to indoor air AF of 0.1 as a conservative screen for vapor intrusion. This AF was updated in the USEPA (2012c) Vapor Intrusion Database to be 0.03 at the 95th percentile. In either case, the data indicate that sub-slab concentrations should be 10 times to 33 times greater than indoor air for sub-slab vapors to be the likely source for the indoor air detections.

AFs for those homes in the Class Area with detections in both sub-slab soil gas and indoor air are presented in Table 2. AFs range from 0.01 to 1.5 for the 16 homes with detections in both sub-slab soil gas and indoor air. These results provide a line of evidence for many homes that vapor intrusion is not the source of the detections in indoor air.

This finding is further supported by the approaches used by USEPA (2012c) to calculate AFs from its Attenuation Factor Database. To eliminate the influence of background concentrations on the calculation of AFs, USEPA eliminated data results when the indoor air was less than background and sub-slab soil gas concentrations were less than 50X background. The remaining data were determined to be representative of potential vapor intrusion issues and USEPA then calculated AFs. For PCE, USEPA used a background concentration of 0.5 µg/m^3 or 0.074 ppbv to eliminate indoor air concentrations and 3.7 ppbv to eliminate sub-slab soil gas concentrations. Had this screening methodology been applied at this site, screening would have eliminated 14 properties based on sub-slab soil gas concentrations and 4 out of 15 homes with indoor air detections of PCE within the Class Area due to background interferences.

3.4. Opinion 4

Concentrations of VOCs in sub-slab soil gas and indoor air do not present or threaten an imminent or substantial endangerment to health or the environment.

Summary of Bases of Opinion

All sub-slab soil gas results are below acceptable screening levels at a 1 x 10^{-5} cancer risk level or a noncancer hazard index of 1. USEPA (1991) Guidance on the Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions outlined the process for determining when a release or threat of a release of a chemical into the environment could "present an imminent and substantial danger to public health…." When evaluating potential carcinogenic risks, USEPA has established a target risk range of 1 x 10^{-4} to 1 x 10^{-6} (USEPA 1991). In establishing this range, USEPA accepted the policy that a risk range, rather than a single risk value, adequately protects public health and the environment (55 FR 8716). USEPA (1991) indicates that if the carcinogenic site risk for both current and future land use is less than 10^{-4} and the non-carcinogenic hazard quotient is less than 1 under reasonable maximum exposure condition, action generally is not warranted.

The sub-slab soil gas and indoor air data collected at the site clearly demonstrate that an imminent or substantial endangerment to human health is not present. PCE was detected at levels well below the sub-slab soil gas Vapor Risk Screening Level at a noncancer hazard of 1, except at three homes previously identified. However, all PCE indoor air results are below the Action Level at a noncancer hazard of 1. Indeed, PCE was not detected in most indoor air samples (Figure 2).

3.5. Opinion 5

Existing mitigation systems, although unnecessary, ensure that VOCs cannot migrate into indoor air.

Summary of Bases of Opinion

The goal of a vapor intrusion mitigation system is to prevent the entry of VOCs into a building. If installed properly, a SSDS or radon system will be effective in preventing VOCs in sub-slab soil gas from entering residential homes. Under these conditions, there are no residual effects or concerns for VOCs in indoor air and the vapor intrusion pathway is incomplete – regardless if it was ever complete in the past.

To address PCE detected in sub-slab soil gas, Madison Kipp installed SSDSs at 150, 154, and 162 South Marquette Street in 2011. These systems were installed as a precautionary measure at two homes that did not have indoor air detections above the PCE Action Level, at the time.[3] Similar precautionary SSDSs were installed at 146 and 166 South Marquette without sub-slab soil gas results.

Within the Class Area, SSDS were installed by WDNR in residential homes if sub-slab PCE concentrations were 10 times below the sub-slab Vapor Risk Screening Level. This overly conservative approach is not only technically unjustified, but is unprecedented in my experience. These mitigation systems will prevent the movement of PCE in sub-slab soil gas into the indoor air of homes. However, it should be noted that mitigation systems would not be necessary for any homes in the Class Area based on the current PCE Action Level. The data collected demonstrate that PCE is not present in either sub-slab soil gas[4] or indoor air at levels that would be indicate that the vapor intrusion pathway is currently complete or could be complete in the future. Instead, these systems unjustifiably convey that PCE concentrations at 10 times below the Action Level or Vapor Risk Screening Level are of potential concern. The presence of SSDS systems may lead residents to perceive that they have a vapor intrusion issue, when in fact none is actually present.

The SSDS do, however, provide an added benefit of reducing potentially elevated radon levels in individual homes. USEPA (2012f) indicates that radon in soil gas and indoor air is one of the most serious public health issues. The World Health Organization (2009) indicates that there is no known threshold below which radon exposure carries no risk. The lower the radon concentration in a home, the lower the risk. In Dane County, data indicate that 35 percent of homes will have a radon concentration greater than 4 picocuries per liter (pCi/L), the recommended screening level (http://county-radon.info/WI/Dane.html) USEPA codes Dane County as Zone 1 – counties have a predicted average indoor radon screening level greater than 4 pCi/L. (http://www.epa.gov/radon/). I have no knowledge of whether homeowners in the Class Area have sampled indoor air for radon; however, if radon were present, the installed SSDS would also address this issue.

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[3] As explained above, the risk screening level for indoor air has been revised upward (i.e. less conservative) since then to 6.2 ppbv.

[4] Please note exceptions identified previously

Similar to the home specific SSDSs, Madison Kipp installed a soil vapor extraction (SVE) system between the site and the homes to the east (ARCADIS 2012a). This system creates a negative pressure differential within the vadose zone by which VOCs in soil or soil gas will preferentially migrate. As installed and operating, the SVE prevents VOCs from migrating off the site into residential yards. Given the demonstrated radius of influence (ROI), the system will also create a pathway by which PCE in off-site soil gas (if any) will be pulled back into the system (ARCADIS 2012a). In effect, the SVE system acts as a barrier to off-site PCE migration on the eastern side of the Madison-Kipp facility.

4. Critique to Expert Report by Dr. Lorne Everett

4.1. Vapor intrusion investigation and regulatory timing

In contrast to Dr. Lorne Everett's findings, the regulatory community was not rapidly moving towards a realization of vapor intrusion in the 1990s. Dr. Everett references a paper by Folkes and Arell (2003) regarding the timing of the awareness of the vapor intrusion pathway. The Folkes and Arell paper states that "..until very recently vapor intrusion was not considered to be a pathway of significant concern." Indeed, USEPA first published OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) in November 2002. Folkes and Arell (2003) clarify that the "historic lack of focus on vapor intrusion is evident by its absence from federal environmental laws and regulations".

The only two documents published by USEPA are described by Folkes and Arell (2003) as "obscure" documents that did not lead to the inclusion of the vapor intrusion pathway in any remedial investigations. In 2003, Folkes and Arell conclude that "the science of vapor intrusion is still in its infancy and regulators are still being trained in the application of the proposed OSWER guidance. Very little information is available in the technical literature" (page 9).

Although Dr. Everett claims that the vapor intrusion exposure pathway "could easily have been discovered and addressed in the 1990s…" (p. 43), there was no regulatory guidance available from USEPA or WDNR to guide that investigation process. The absence of such guidance confirms it was atypical to focus on this pathway in the mid to late 1990s. Moreover, regulatory agencies were not yet routinely requiring vapor intrusion investigations as part of a remediation investigation. Clearly none was requested of Madison Kipp by WDNR until 2004. Dr. Everett's own paper seems to support the finding that investigation of the vapor intrusion pathway is a relatively new phenomenon. Dr. Everett states "…for the majority of contaminant releases, the vapor intrusion pathway often was not considered or typically was not given as much attention as the groundwater transport pathway. While many fine [vapor intrusion] exceptions exist, until very recently, the emphasis on groundwater monitoring has dominated the environmental assessment and remediation industry" (Kram et al. 2011, page 60).

4.2. Spatial and temporal variability

Dr. Everett claims that the data collected do not address or adequately evaluate spatial and temporal variability. He attempts to substantiate this claim with an irrelevant comparison to weather changes (p. 45). It is well known that the temperature varies significantly in Wisconsin over the course of a year. In my experience, it is inappropriate to compare temperature changes (which are obviously well documented) to potential variability in sub-slab or indoor air concentrations.

Dr. Everett cites his recent paper "Dynamic Subsurface Explosive Vapor Concentrations: Observations and Implications" as evidence that additional data are needed to address temporal variability. However, Dr. Everett fails to mention that his study focused on soil gas data (which is known to have greater variability than sub-slab data) and not sub-slab soil gas data (USEPA 2012a,c). Dr. Everett's study also focused on methane and was collected at a site where petroleum compounds, not chlorinated solvents were present. It is well known that CVOCs act differently in the environment compared to petroleum compounds (USEPA 2011b). In contrast to Dr. Everett's claims, sub-slab soil gas concentrations are remarkably consistent over time at most homes in the Class Area.

Dr. Everett also claims that the site-specific data collected from the Class Area do not provide data over an extended time period and spatial area when considered as a whole. This finding is completely unsubstantiated. Within the Class Area (and excluding the three homes identified above), sub-slab soil gas concentrations for PCE ranged from ND (<0.15 ppbv) to 17 ppbv over 59 different sample points. This variability in results is insignificant when compared to the much higher sub-slab Vapor Risk Screening Level. Moreover, these data results were collected over an extended time period, from March 2012 through November 2012. In most cases, two sub-slab samples were collected from each home, again providing data from more than one time period. Intensive continuous monitoring is highly unlikely to identify different conditions than those that have already been thoroughly demonstrated. In my opinion, the data are not sufficiently variable to justify continuous monitoring. Moreover, it is very clear, based on the extensive data set that sub-slab soil gas and indoor air concentrations are not even close to those levels that would trigger additional monitoring or mitigation.

Dr. Everett also claims that variability in on and off-site soil gas results provides further evidence of the need for on-going or additional monitoring of sub-slab soil gas and indoor air from individual homes. This claim is also not substantiated and does not relate to variability in sub-slab soil gas data. Several studies are available that document variability in soil gas data, especially that data collected at a distance above the water table (as was done at Madison Kipp) (USEPA 2012e, Swanson, Elliot et al 2009). Data from other sites have confirmed intra-site variability of at least an order of magnitude (USEPA 2012e). This variability in soil gas does not provide similar predictions for variability in sub-slab soil gas data (USEPA 2012d). In particular, the variability in soil gas data may be due to several factors including weather conditions, moisture content, soil type, and analytical methods.

More importantly, despite variations in both on-site and off-site soil gas concentrations, the data show a significant decreasing trend moving from on-site to off-site; confirming that concentrations of CVOCs migrating off-site in soil gas are consistently lower than those found on-site as well as generally below levels requiring regulatory action. PCE was not detected in off-site soil gas in the first three quarters of sampling using standard practices (RSV 2007). The results from October 2006 through April 2007 clearly indicated that PCE was not migrating off-site at concentrations similar to those measured on-site. Off-site concentrations of PCE remained several orders of magnitude lower compared to on-site concentrations over the same time period.

In August 2007 and September 2007, the soil gas data showed three orders of magnitude decrease in most samples moving from on-site to off-site. This trend of decreasing concentrations from on-site to off-site continued through the September 2009 quarterly sampling event. This data trend clearly demonstrates that soil gas concentrations decreased significantly from the on-site property to beneath the backyards of nearby residences.

Additional sampling in June 2011 in yards of 142 and 202 South Marquette also confirmed that soil gas was not migrating laterally from the source area identified near MW-5 (RJN 2011b; WDNR. 2011b). The results from both these soil gas concentrations were well below the soil gas Vapor Risk Screening Levels at the time.

4.3. Source identification

Dr. Everett claims that the vapor intrusion pathway cannot be adequately addressed because it has not been definitely determined if groundwater or soil is the source of PCE detected in soil gas (p. 44). While such information can be useful for targeting remediation of sources, from a practical standpoint it is irrelevant to evaluating and addressing the vapor intrusion pathway. Sub-slab soil gas data will characterize the significance of a vapor intrusion issue regardless of whether the chemical of concern originates from soil or groundwater. PCE in shallow groundwater and on-site soils has been fully delineated, thereby allowing for a full assessment of the vapor intrusion pathway.

Moreover, despite Dr. Everett's claims (p. 33), there is no natural mechanism by which PCE vapors could migrate downward and laterally under an individual's home. As discussed previously, PCE in soil gas will move from areas of higher pressure or concentration to areas of lower concentration or pressure. PCE detected in shallow soils in residential yards has no pathway to migrate under homes, but will instead migrate to ambient air.

4.4. Soil gas delineation

Dr. Everett falsely claims that the extent of soil gas has not been delineated. Sub-slab soil gas and indoor air data have been collected from all homes in the Class Area where the homeowners have allowed access as well as several homes outside the Class Area. In all cases, the data confirm that PCE has not migrated beyond the Class Area. All sub-slab soil gas concentrations within the Class Area are below the PCE Vapor Risk Screening Level with the exception of the 2011 sampling of 150, 154, and 162 South Marquette Street (Figure 1). Similar concentrations of PCE – at levels well below the Vapor Risk Screening Level – were detected under homes outside the Class Area. In my experience, if a soil gas plume were present associated with the Madison Kipp site, one would expect to see some sort of concentration gradient where sub-slab soil gas concentrations were highest closest to the source area and near the highest groundwater concentrations, and then generally diminish with increasing distance from these locations. There is no indication of any such concentration trend in the sub-slab soil gas and indoor air data.

Moreover, shallow groundwater sampling confirms that PCE was not detected in shallow groundwater collected from wells installed in the area of South Marquette and

Waubesa Streets. In the absence of PCE in groundwater, there is no potential for PCE vapors to migrate from the Site to additional off-site areas.

Dr. Everett mischaracterizes Madison-Kipp's understanding of the soil gas plume (p. 34). The data collected to date do confirm that vapor probes were only needed on the few homes directly adjacent to the facility. Subsequent sampling has confirmed that PCE is not present above Vapor Risk Screening Levels at properties both within and outside the class, with the exception of three directly adjacent to the facility.

4.5. Preferential pathways

Dr. Everett asserts that it is premature to make any conclusions regarding preferential pathways (p. 39). Information on sewer lines shows that there are no utilities that connect on-site areas with off-site homes (ARCADIS 2012b). Moreover, the data do not indicate that a preferential pathway is present. If such a pathway were present within the Class Area, we would expect to see higher concentrations of PCE in some areas; and potentially in areas that are unexpected. No such data exist.

4.6. PCE Detections

Dr. Everett asserts that any detection of PCE in sub-slab vapor constitutes an on-going threat and indicates that properties have been impacted. This claim directly contradicts WDNR (2010a) vapor intrusion guidance which states that concentrations below the Vapor Risk Screening Levels and Action Levels do not indicate a vapor intrusion concern. As stated previously, many studies have documented PCE in background air. PCE could be found in any home sampled, even those not near an industrial facility. In fact, it is my experience that VOCs are almost always detected when sampling is done in residential homes. These results do not blindly lead to the conclusion that vapor intrusion is occurring.

5. Signature Page

Attachment B to this report presents a copy of my current Curriculum Vitae, a list of publications which I have authored in the past 10 years, and a list of cases in which I have provided expert testimony during the past 4 years. My firm, ARCADIS U.S., Inc., (ARCADIS), charges $200 per hour for my time on this project.

Nadine Weinberg
1/21/13

Nadine Weinberg — Date
Principal Scientist/ Associate Vice President
ARCADIS U.S., Inc.

Table 1. Calculation of Site-Specific Attenuation Factors

	113 S. Marquette		118 S. Marquette		123 S. Marquette		123 S. Marquette		151 S. Marquette		206 S. Marquette		230 Waubesa		233 Waubesa		
	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Sub-Slab	Ambient
Date	7/2/12	7/2/12	9/17/12	9/17/12	4/25/12	4/25/12	7/2/12	7/2/12	8/2/12	8/2/12	7/5/12	7/5/12	6/4/12	6/4/12	4/12/12	4/12/12	4/12/12
Tetrachloroethylene	0.228	0.336	2.34	0.318	0.715	0.227	1.64	0.264	0.276	0.317	0.678	0.483	1.27	0.125	0.502	0.462	0.307
Attenuation Factor	1.5		0.14		0.32		0.16		1.15		0.71		0.10		0.61		

	233 Waubesa		234 Waubesa		234 Waubesa		245 Waubesa			249 Waubesa		253 Waubesa		257 Waubesa		266 Waubesa	
	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient	Sub-Slab	Ambient
Date	6/4/12	6/4/12	4/25/12	4/25/12	6/4/12	6/4/12	5/17/12	5/17/12	5/17/12	6/7/12	6/7/12	4/12/12	4/12/12	4/12/12	4/12/12	6/7/12	6/7/12
Tetrachloroethylene	1.45	0.376	0.385	0.297	0.781	0.182	9.22	9.23	0.524	5.99	5.88	4.90	0.099	9.99	0.107	3.97	1.31
Attenuation Factor	0.26		0.77		0.23		0.057			0.98		0.020		0.011		0.33	

LEGEND

- PCE DETECTED ≤ 6.2 PPBV
- 6.2 PPBV < PCE < 17 PPBV
- PCE DETECTED > 62 PPBV
- BUILDINGS
- PARCELS

0 50 100
Feet

MADISON-KIPP
201 WAUBESA STREET
MADISON, WI

SUB-SLAB VAPOR PCE ANALYTICAL RESULTS FEBRUARY 2011 - NOVEMBER 2012

ARCADIS

FIGURE
1

NOTES:
1. WDNR SUB-SLAB VAPOR ACTION LEVEL = 60 PPBV.
2. MAXIMUM SUB-SLAB VAPOR RESULT USED TO INDICATE COLOR CODED CATEGORIES.
3. PCE SAMPLING RESULTS INCLUDED AT LEAST ONE NON-DETECTED VALUE.

CITY: MPLS DIV/GROUP: IM DB: MG LD: CK
MADISON-KIPP
Path: G:\GIS\Projects\Madison_Kipp\ArcMap\Sub_Slab_PCE_20130115.mxd

LEGEND

- PCE NON-DETECT
- PCE DETECTED < 0.6 PPBV
- 0.6 PPBV < PCE < 6.2 PPBV
- BUILDINGS
- PARCELS

0 50 100
Feet

NOTES:
1. WDNR INDOOR AIR ACTION LEVEL = 6 PPBV.
2. MAXIMUM INDOOR AIR RESULT USED TO INDICATE COLOR CODED CATEGORIES.
3. PCE SAMPLING RESULTS INCLUDED AT LEAST ONE NON-DETECTED VALUE.

MADISON-KIPP
201 WAUBESA STREET
MADISON, WI

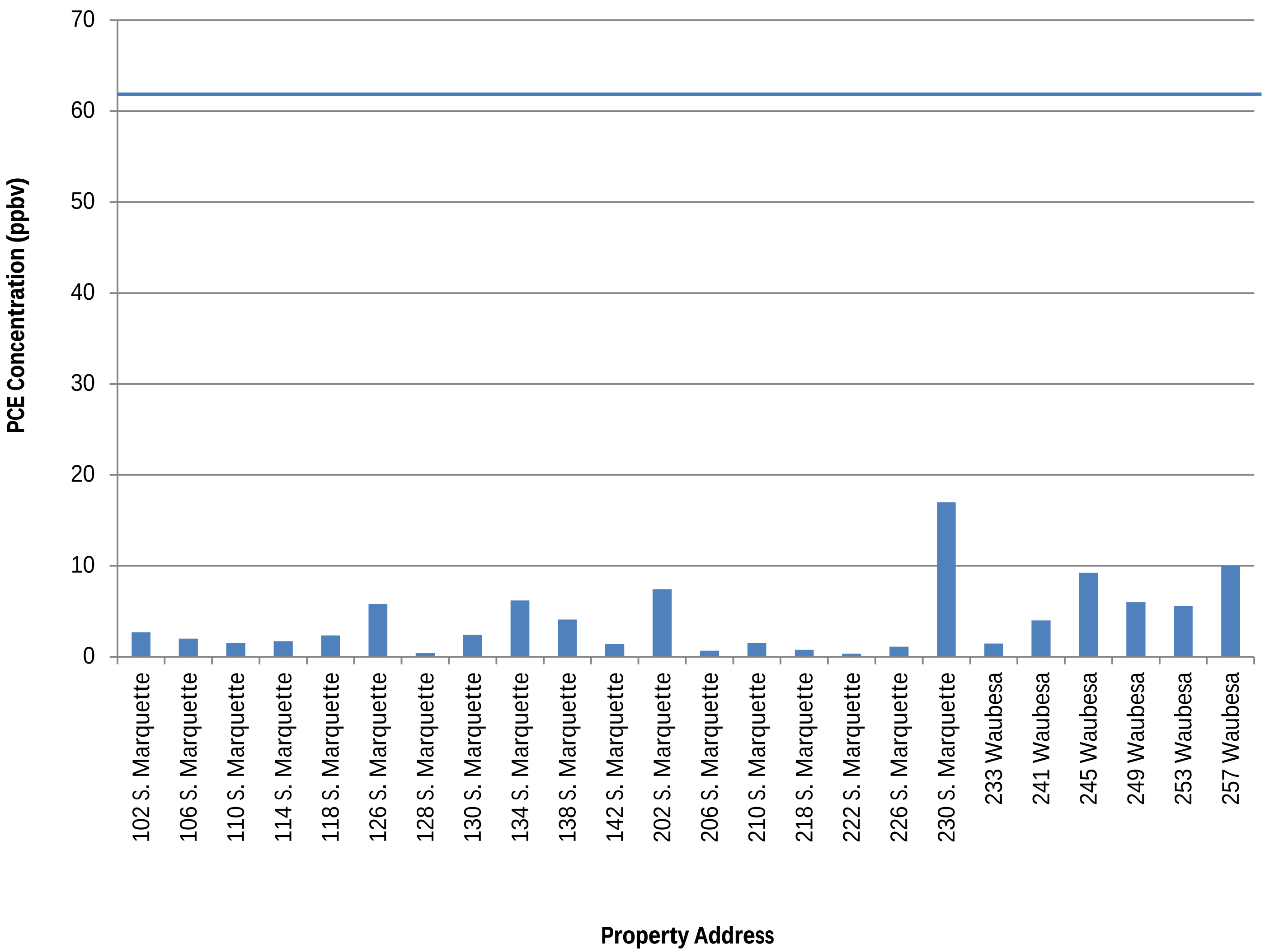
INDOOR AIR PCE ANALYTICAL RESULTS FEBRUARY 2011 - NOVEMBER 2012

ARCADIS

FIGURE 2

CITY: MPLS DIV/GROUP: IM DB: MG LD: CK
MADISON-KIPP
Path: G:\GIS\Projects\Madison_Kipp\ArcMap\Indoor_Air_PCE_20130115.mxd

Figure 3. PCE Sub-Slab Vapor Concentrations per Household



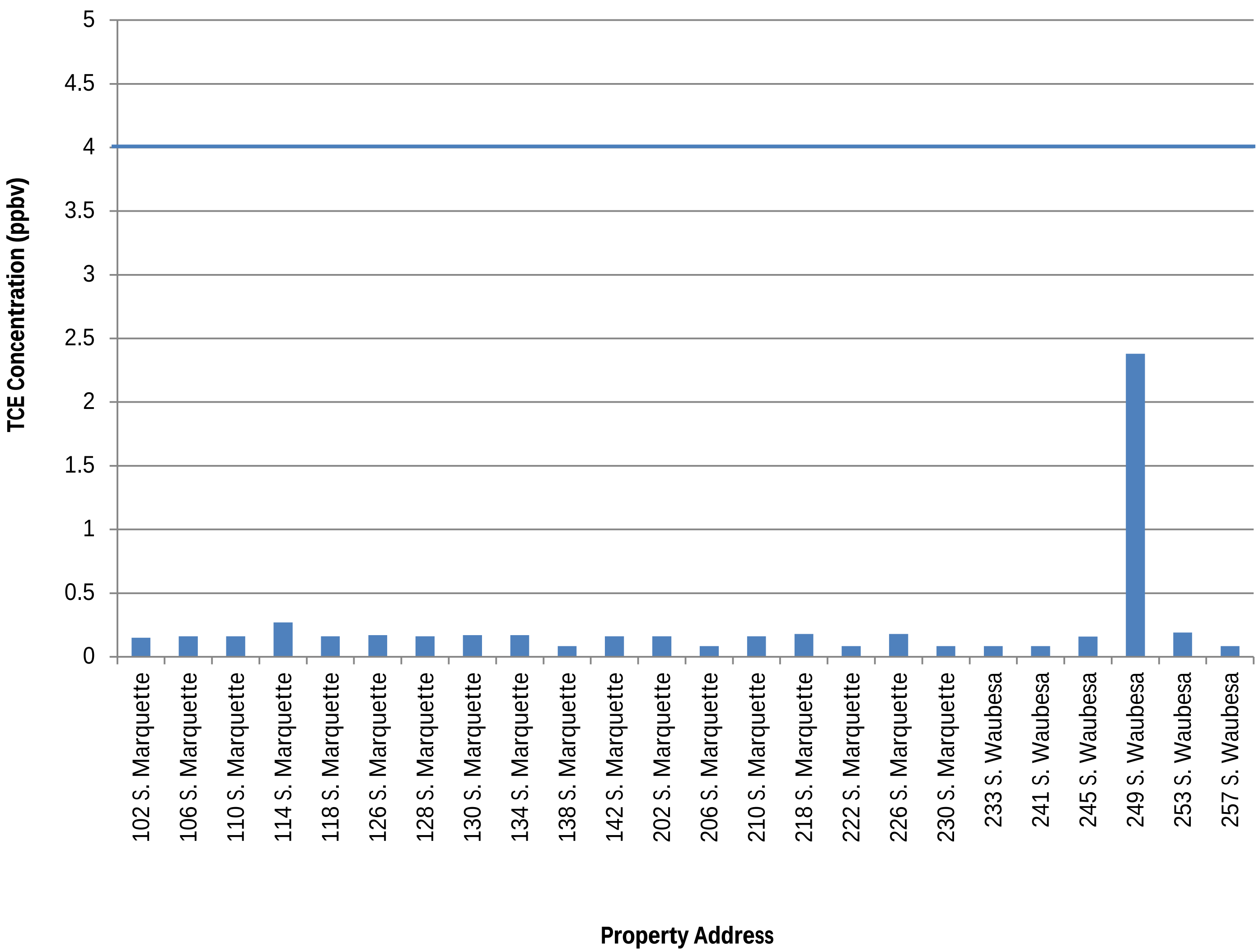
Notes:

= Sub-slab Vapor Risk Screening Level.

PCE = Tetrachloroethene.
ppbv = Parts per billion per volume.

The maximum detected PCE concentration was used.

Figure 4. TCE Sub-Slab Vapor Concentrations per Household



Notes:

= Sub-slab Vapor Risk Screening Level.

TCE = Trichloroethene.
ppbv = Parts per billion per volume.

The maximum detected TCE concentration or the maximum detection limit was used.