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Expert Report of
Thomas M. Johnson, P.G.

Kathleen McHugh and Deanna Schneider et al.
v. Madison-Kipp Corporation et al.
U.S. District Court,
Western District of Wisconsin
(Case No. 11-CV-724)

January 21, 2013

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1. Introduction

This report presents the expert opinions of Thomas M. Johnson, P.G., Executive Vice President, Technical Director, and Principal Hydrogeologist for ARCADIS U.S., Inc. (ARCADIS), regarding alleged environmental impacts in the vicinity of the Madison-Kipp Corporation (Madison-Kipp) facility at 201 Waubesa Street, Madison, Wisconsin (the site).

This report was prepared for Michael, Best & Friedrich, LLP (Michael Best) on behalf of Madison-Kipp in conjunction with litigation captioned Kathleen McHugh and Deanna Schneider et al. v. Madison-Kipp Corporation et al., U.S. District Court, Western District of Wisconsin (Case No. 11-CV-724). Appendix A presents additional supporting materials that provide additional bases for my opinions. A list of the documents referenced in this report, reviewed, or relied upon is presented in Appendix B. A copy of my curriculum vitae, which includes a list of publications that I have authored in the past 10 years, is presented in Appendix C. Appendix C also includes a list of the cases in which I have testified as an expert witness during the past four years. Because review of documents is ongoing and ARCADIS is continuing to receive information and documents regarding the site, the information and opinions presented in this report may be modified as additional information is reviewed or becomes available.

The opinions set forth in this report are presented to a reasonable degree of scientific certainty and are based on a review of the documents provided by Michael Best, documents and information obtained by ARCADIS, review of the files of the Wisconsin Department of Natural Resources (WDNR), interviews with current and former Madison-Kipp employees, interview of Madison-Kipp environmental consultant, my education and experience, and personal inspection of the Madison-Kipp facility and surrounding area. My opinions also rely on methods of analysis and equations that are generally accepted and are commonly used by hydrogeologists, scientists, and engineers to evaluate environmental, hydrogeologic, and groundwater conditions.

2. Summary of Expert Opinions

The following presents my expert opinions and a summary of the bases for those opinions regarding environmental conditions at the Madison-Kipp facility and in the surrounding area.

2.1 Expert Opinion 1

Madison-Kipp‘s use, handling, and disposal of industrial products, including tetrachloroethylene (PCE) and oils, was consistent with the standard of care in the industry at the time.

2.1.1 Summary of Bases for Opinion

2.1.1.1 Tetrachloroethylene (PCE)

PCE Use

Historically, PCE has been used widely in metal degreasing operations at industrial facilities, and continues to be used in numerous industrial, commercial, and household cleaning products, as well as in dry cleaning processes. The peak years of PCE production occurred during 1975-1980, when as much as 700 million pounds of PCE was manufactured annually (Morrison 2000a; Doherty 2000a). The primary use for PCE since the 1930s in the United States has been for dry cleaning, and PCE is still used extensively for dry cleaning purposes today (Morrison 2000a). In 1967, approximately 88 percent of all PCE produced in the United States was used in dry cleaning, while metal degreasing and cleaning accounted for 10 to 15 percent of PCE production (Morrison 2000a). PCE was commonly used in industry for degreasing aluminum materials in manufacturing, due to the high stability of PCE(Doherty 2000a).

PCE Use at Madison-Kipp

Based upon interviews with current and former employees, PCE was used to clean metal parts prior to manufacturing (Jellings 2012; Keyes 2012; Largen 2013; Lenz Dep. 2012, p. 37; Lenz 2013; Schluter 2012). PCE was also used to clean grease and dust from Madison-Kipp’s die cast machines (Keyes 2012; Lenz Dep. 2012, p. 61).

Based on these interviews, Madison-Kipp used a PCE vapor degreaser that was 8 feet (ft) long, 4 ft in depth, and 4 ft high, with a ventilation hood and ducting that vented to the outside (Keyes 2012; Lenz Dep. 2012, p 38). This vapor degreaser held 75 to 100 gallons of PCE (Lenz Dep. 2012, p. 41). The degreaser was heated with natural gas and included a cooling system (condenser) that produced the vapor cloud that the degreaser used to clean the metal parts (Keyes 2012; Schluter 2012). Based upon employee descriptions, this vapor degreaser was similar to that described in the 1962 and 1976 ASTM International (ASTM) Vapor Degreaser Handbooks (ASTM 1962, 1976), and is also consistent with my experience.

When used by the Die Cast Division, the vapor degreaser was located along the eastern wall of the Atwood Building (Lenz Dep. 2012, p. 42; Schluter 2012). It was later transferred to the Lubricator Division and physically moved to a location in the Waubesa Building (Lenz Dep. 2012, p. 64), where it was used until the late 1980s. At both locations, the vapor degreaser was present inside the building and ventilated to the outside.

In addition to the vapor degreaser described above, employees also report that there was formerly a smaller PCE parts cleaner or degreaser, approximately 3 to 4 ft square and 4 ft tall (Keyes 2012). Metal parts were reportedly cleaned by dipping parts directly into the liquid PCE in this parts cleaner.

Based upon my experience and review of industry guidance (ASTM 1962, 1976), the use of PCE as a solvent for degreasing was a common and accepted industrial practice up to and including the late 1980s, when its use at Madison-Kipp ceased. The use of PCE solvent for degreasing as described by current and former employees meets the standard of care recognized in the industry at the time.

PCE was also used to clean Madison-Kipp die machines through sometime in the 1980s. If PCE would drip onto the floor adjacent to the machine being cleaned, it would be cleaned up using “oil-dri” (Lenz Dep. 2012, p. 62). There were no floor drains in the area of the die cast machines. The practice of using solvents, including PCE, for this purpose was also entirely consistent with industry practice at the time.

PCE Storage and Handling at Madison-Kipp

Until the vapor degreaser was transferred to the Lubricator Division, PCE used by the Die Cast Division was stored in an aboveground storage tank (AST) located in the oil shed. (Jellings 2012). The oil shed had a concrete floor (Lenz Dep. 2012, p. 69). Thereafter, PCE was stored in an AST located on a concrete pad in the alcove outside the east wall of the Waubesa Building (Lenz Dep. 2012, p. 42). PCE would be delivered by a tanker truck that would use a hose system to fill the AST (Keyes 2013). PCE transfer from the AST to a degreaser was commonly performed by employees filling buckets through a spigot on the

AST, placing the buckets on a rolling cart, and transporting the buckets to a degreaser and pouring the PCE into the degreaser (Lenz Dep. 2012, pp. 39, 41; Schluter 2012). A similar process was used for obtaining PCE to clean the die cast machines. These methods of receiving, storing, and handling PCE are consistent with industry standards and practice at the relevant time. This opinion is not only based on my experience, it is consistent with industry guidance (ASTM 1962, 1976).

PCE Reclamation and Disposal at Madison-Kipp

Since at least 1971, spilled waste liquids and sludge, including those containing PCE, were transferred into a 500-gallon waste container and removed by a waste hauler (Jellings 2012; Keyes 2012; Largen 2013; Lenz 2013; Schluter 2012). No current or former employees recall solvent or waste of any kind being disposed outside the building, except for use as dust suppression (discussed elsewhere herein).

Periodically, the degreasers would have been cleaned to remove accumulated degreasing waste and sludge. Consistent with my experience and industry guidance for the operation of degreasers (ASTM 1962, 1976), used PCE was recovered and recycled for reuse through the use of a still operated at various times by Madison-Kipp former employee, Joe Lindsay, (Jellings 2012; Schluter 2012). Industry guidance recommended reclamation of PCE solvent to decrease PCE solvent costs (ASTM 1962, 1976). After removing the used PCE for reclamation, the remaining waste would consist of a semi-solid sludge comprised of oils, metal particles, dirt, and PCE residue (ASTM 1962, 1976). Although there is no direct evidence that it was done at Madison-Kipp during the period from the 1940s to 1970s, industry guidance regarding the disposal of chlorinated solvent waste recommended that PCE waste be poured on the ground (ASTM 1962, 1976; Manufacturing Chemists' Association, Inc. [MCA] 1948). Thus, if this were done at Madison-Kipp, it would have been consistent with industry standard and guidance at the time.

2.1.1.2 Polychlorinated Biphenyls (PCBs)

PCB Use

PCBs were produced in the United States beginning in 1929 for a variety of industrial uses, including electrical transformers and capacitors and oils used in hydraulic systems, paints, coatings, and plastics (Morrison 2000a). For many decades prior to the late 1970s, when production was essentially stopped, PCBs were commonly present in waste oils because of chemical properties that were exceptionally useful in industrial applications, such as hydraulic oils. Production of PCBs peaked in 1970, and production essentially ceased in the

United States in 1979, when most PCB use was banned by the U.S. Environmental Protection Agency (USEPA) (Morrison 2000a). Until 1974, PCBs were used in many industrial applications; however, after 1974, PCB use was limited to electrical transformers and capacitors (Morrison 2000a). Due to limitations in analytical methods, it was not until 1970 that PCBs could be detected in environmental samples (Morrison 2000a).

Use of PCB-Containing Material at Madison-Kipp

At some point in time, hydraulic oils containing PCBs were used at Madison-Kipp. Records indicate that the last purchase of hydraulic oils containing PCBs was in 1971 (Ecology and Environment, Inc. 1983). Use of hydraulic oils that may have contained PCBs was consistent with industry standards at the time, and no claim to the contrary has been made by Plaintiff's experts.

Storage, Handling, and Disposal of PCB-Containing Material at Madison-Kipp

Hydraulic oil containing PCBs was kept in the oil shed in two large, approximately 3,000-gallon ASTs (Keyes 2013). The hydraulic oil would have been delivered by tanker truck and transferred into these ASTs through a hose that connected to a coupling outside the shed (Keyes 2013; Schluter 2012). Hydraulic oil was historically supplied to the die cast machines through a central hydraulic piping system that serviced multiple machines (Keyes 2013). Hydraulic oil was transported from the large ASTs in the oil shed in 55-gallon drums on rolling carts (barrel carts) to a central reservoir in the facility (Keyes 2013). The hydraulic fluid in this central hydraulic system was then supplied to die cast machines in a closed loop system through pipelines within a concrete-lined trench oriented north/south in the Atwood Building (Keyes 2012; Lenz 2013; Schluter 2012). The trench was approximately 4 ft wide, 2 to 4 ft deep, and covered with steel plates. It did not connect or discharge to any sewer or drain system in the facility (Keyes 2012; Schmoller Dep. 2012, p. 286). This process was subsequently changed, as newer die cast machines had individual hydraulic systems and hydraulic oil reservoirs at each machine (Keyes 2013). Hydraulic oil was transferred to each of these newer machines in 55-gallon barrel carts and pumped into the machine (Keyes 2013).

From time to time, wastes including hydraulic oils, PCE, water, and other liquids would have entered the concrete-lined trench. These wastes and spill residues that may have occurred on the Madison-Kipp plant floor were suctioned into an industrial vacuum (Seacor machine), transferred to a waste container, and removed off site by a waste hauler (Jellings 2012; Keyes 2012; Lenz Dep. 2012, p. 62; Lenz 2013; Schluter 2012).

Madison-Kipp's storage, handling, and disposal of hydraulic oil were consistent with industry standards. Plaintiff's experts have offered no opinion to the contrary.

Use of Waste Oil as Dust Suppressant at Madison-Kipp

Until the parking lots were paved in 1976 or 1977, waste oils, which may have contained PCBs or PCE, were periodically applied using the industrial vacuum (Seacor machine) to the parking areas as a dust suppressant (Schluter 2012). Use of waste oils for this purpose was consistent with industry practices and met the standard of care at the time.

The use of waste oils for dust control and use of oils and tar on roadways for dust suppression has been commonplace for decades throughout the United States (CSWAB 2005; Ledbetter 1983; Mueller Associates, Inc. 1987; USEPA 1984a, 1984b). These waste oils usually contained many contaminants, including heavy metals, organic solvents, and PCBs (USEPA 1984a, 1984b). Studies by USEPA, U.S. Department of Energy, and others indicated that waste oils used for road oiling typically contained high concentrations of PCBs, as high as 3,800 parts per million (Ledbetter 1983; Mueller Associates, Inc. 1987; USEPA 1984a, 1984b;).

In 1982, USEPA estimated that approximately 50 to 80 million gallons of waste oil was being used in the United States for dust suppression on unpaved roads(USEPA 1984a, 1984b). Wisconsin was one of the states that used the largest quantities of waste oil on roads for dust suppression (Ledbetter 1983; USEPA 1984a, 1984b). This included the use of large quantities of waste oil on unpaved roads (road oils) in the 1980s for dust suppression at the Badger Army Ammunition Plant in Baraboo, Wisconsin (CSWAB 2005). It was not until 1992 that USEPA banned the use of road oils for dust suppression, due to the possible presence of hazardous substances (CSWAB 2005). Although the use of waste oil for unpaved roads has declined since the 1990s, as recently as 2006, Wisconsin regulations permitted the use of used oil for dust suppression (NR 679.62). In fact, based on my experience, it is still common practice to use petroleum oil and tar for dust control on roads in the United States.

This is also true from my personal experience since 1975 in the environmental industry, and previously from my experience as an employee of the DuPage County, Illinois, Forest Preserve District in 1967 and 1968 when I worked in the maintenance department and was directed to spread waste oil on Forest Preserve District gravel roads for dust suppression.

2.2 Expert Opinion 2

The environmental site investigations and remedial activities conducted by Madison-Kipp, and the timing of those activities, have been consistent with the standards of practice for such activities at the time.

In July 1994, in response to a letter from WDNR (WDNR 1994) regarding the detection of PCE in groundwater at the adjacent Madison Brass Works site to the north, Madison-Kipp retained the environmental consulting firm of Dames & Moore, Inc. (Dames & Moore) to prepare a work plan for site investigation. This work plan was submitted to WDNR in September 1994 (Dames & Moore 1994a).

Multiple phases of site investigation have been conducted at the site for Madison-Kipp by a number of environmental consultants beginning in 1994. These site investigations have focused on evaluating soil and groundwater conditions and the magnitude and extent of contamination at the site under the direct oversight of WDNR.

Although the full extent of the site area contamination was not entirely known from initial phases of investigation, each of these investigation phases provided the information needed at the time, regarding the soil and groundwater conditions and the extent of contamination in the area of investigation, to make decisions regarding further investigation and remedial actions (Schmoller Dep. 2012, p. 56). Such an investigation conducted in a phased or step-wise fashion was and is the standard in the industry. As to be expected, there have been occasional disagreements with WDNR regarding site activities, including the timing of those activities (Schmoller Dep. 2012 Exhibit 26, p. 206; Exhibit 34, p. 292). In my experience, such disagreements are not unusual given the nature of subsurface contamination, the complexity of the subsurface environment, and evolutions in technical knowledge and regulations. As a consequence, the process typically takes years. In my opinion, the WDNR project manager, Michael Schmoller, has correctly concluded that site investigations and remedial actions since 1994 were “appropriate and adequate” at the time they were conducted (Schmoller Dep. 2012, p. 56).

Further investigations and evolving technical knowledge over time have resulted in increased awareness of the significance and impacts of contamination at the Madison-Kipp site and surrounding area. This includes increased awareness of possible importance of vapor intrusion from volatile organic compounds (VOCs) in the subsurface in 2009 through 2012. For example, WDNR project manager, Michael Schmoller, has indicated that the vapor intrusion issue was not understood at the time of the initial investigations conducted at the Madison-Kipp site (Schmoller Dep. 2012, p. 14).

In 2006, as part of a Phase I Environmental Site Assessment (ESA), Madison-Kipp's consultant became aware of anecdotal information suggesting that PCB-containing oils may have been historically used for dust suppression in the north parking lot. Since the parking lots were paved and/or covered by the building in 2006, there was no immediate need for action. In my opinion, PCBs in soils under paved areas or buildings, such as at Madison-Kipp, would not be addressed or even investigated until and only if excavation of soils occurred at the site, or in the context of requesting regulatory closure for soil at a site.

During the installation of the soil vapor extraction (SVE) system in 2012, PCBs were detected in sampling of excavated soil performed to characterize those soils prior to appropriate disposal of the soils (ARCADIS 2012e). Since then, an extensive on-site and off-site soil investigation has been conducted, and on-site excavation of PCB-impacted soils has been completed. Based on the information available prior to the 2012 discovery of PCBs in on-site soils, there was no evidence to indicate that PCBs would be present in off-site soils. When PCBs were detected in soils during the SVE installation, the results also indicated the presence of other polynuclear aromatic hydrocarbons (PAHs). In my opinion, Madison-Kipp has subsequently responded appropriately in conducting further investigations and remediation to address PCBs and PAHs in on-site and off-site soil.

Since 1994, Madison-Kipp has maintained continuous communications and interaction with WDNR throughout the site investigation process. This has included submittal of required reports of site investigation and remediation activities; routine status reports; and regular meetings, correspondence, and telephone communications with the WDNR project manager and other agency representatives. Madison-Kipp's activities in this regard have been consistent with the standard of care for potentially responsible parties in environmental cleanup matters.

2.3 Expert Opinion 3

Site investigations at the Madison-Kipp facility and surrounding area have defined the extent of PCE, PCBs, and other site-related contaminants in soil, soil vapor, and groundwater for the purposes of selecting remedial actions.

2.3.1 Summary of Bases for Opinion

2.3.1.1 Extent of Contamination

Based on the locations and timing of contaminant sources that have been identified at the site, the distance to adjacent properties, the shallow depth to groundwater, and the extent and magnitude of PCE and other contaminants that have been found in the subsurface, PCE, PCBs, PAHs, and other contaminants were already present in soil and/or shallow groundwater beneath the Madison-Kipp site and immediately adjacent surrounding properties well before 1994, and have not materially increased in lateral extent or magnitude since that time.

2.3.1.2 Soil Vapor

It is my opinion, with which WDNR concurs, that the extent of PCE and other VOCs in soil vapor in the off-site area has been defined, and that there is an adequate understanding of the site conceptual model at this time regarding VOC occurrence and migration in soil vapor (Schmoller Dep. 2012, pp. 33, 240). In fact, PCE has not been detected in shallow groundwater beyond the area of residential properties immediately adjacent to Madison-Kipp and, therefore, could not be a source of VOCs to soil vapor beyond that area. Furthermore, it is my opinion, with which WDNR concurs, deeper groundwater is not a source of VOCs to soil vapor in the vadose zone (Schmoller Dep. 2012, p. 102).

In addition to PCE, multiple other VOCs, including petroleum compounds, have been detected in soil vapor samples on various residential properties (ARCADIS 2013b). However, these VOC compounds are commonly present in ambient air in urban areas, and within residences as a result of household chemical use, as well as from dry cleaning and building materials (USEPA 2011). WDNR has concluded that many of the VOCs detected in sub-slab soil vapor and indoor air at residential properties in the site area are present in ambient air, and may have resulted from sources within the residences (Schmoller Dep. 2012, p.128). Furthermore, many of the VOCs detected in soil vapor or indoor air on adjacent residential properties have not been detected on the Madison-Kipp property (ARCADIS 2013b; Schmoller Dep. 2012, p. 131). Most importantly, the current SVE system is controlling the off-site migration of soil vapor containing VOCs (Schmoller Dep. 2012, p. 76).

In the off-site area, it is my opinion that further investigation of VOCs in soil vapor is not needed because there is no migration pathway, and shallow groundwater beyond the area immediately adjacent to Madison-Kipp does not contain VOCs (Schmoller Dep. 2012, p. 88). WDNR project manager, Michael Schmoller, further testified that no further sampling of soil vapor is planned to be required in the areas east of South Marquette Street, west of Waubesa Street, or on Dixon Street (Schmoller Dep. 2012, p. 224). PCE in soil vapor samples from residential locations in these areas further from Madison-Kipp are likely not due to releases at Madison-Kipp, as PCE has not been detected in shallow groundwater and sub-slab soil vapor samples in these areas. PAHs and PCBs have correctly not been identified as a source of contamination in soil vapor.

This opinion is further supported by the hydrogeological conditions in the Madison area and at the site, as discussed in Appendix A.

2.3.1.3 Soil

In my opinion, through multiple phases of site investigation, the magnitude and lateral extent of soil contamination at the site and surrounding area has been defined and will not materially change in the future, even if no further remediation occurs. I agree with WDNR that there is "a good understanding" of soil contamination in the east and northwest portions of the site, and that no further investigations are needed in those areas (Schmoller Dep. 2012, p. 72). Soil investigations in the southwest portion of the site and beneath the facility building were conducted in 2012 (Schmoller Dep. 2012, p. 72). Moreover, WDNR has correctly concluded there is a good understanding of shallow soil contamination (at depths to 4 ft below ground surface [bgs]) from the more than 100 soil borings that have been completed at the site (Schmoller Dep. 2012, p. 73).

Chemical analyses for PCBs have been conducted on more than 300 samples from on-site and off-site areas (ARCADIS 2013b). These sample results have, in my opinion, defined the extent of PCB contamination in the soil for the purposes of selecting remedial actions to address PCB impacts to soil.

Soil sampling results from residential properties during 2012 indicate that one or more PAH compounds have been detected in soils at concentrations above one or more WDNR PAH screening levels at most residential properties in the area and on the Madison-Kipp property (ARCADIS 2013a). ARCADIS has correctly concluded that PAHs are ubiquitous in an urban environment from many different activities, the majority of which are not related to activities at Madison Kipp (ARCADIS 2013a). In a subsequent letter from WDNR, Madison-Kipp was directed to submit a work plan "either…for determining whether any of the health-based direct contact exceedances can be attributed to background concentrations or…a remedial action plan to be employed by MKC…" (WDNR 2012aa). On December 14, 2012, ARCADIS submitted a work plan to WDNR to evaluate background levels of PAHs in the site area (ARCADIS 2012s). Results of this study, which has included review of PAH sources in the Madison area, statistical analysis of on-site and off-site PAH sampling data, and a forensic evaluation of fingerprint analyses of PAHs in urban area soils, indicate that PAHs in soils on residential properties are consistent with background levels in urban areas and are not related to Madison-Kipp source-derived PAHs found in soils at Madison-Kipp (ARCADIS 2013a).

2.3.1.4 Groundwater

Shallow Groundwater

In my opinion, the magnitude and lateral extent of PCE in shallow groundwater has not materially changed since a time well before it was first discovered in 1994, and will not materially change in the future, even if no further remediation occurs. In my opinion, the direction of groundwater flow at the site has been variable. Shallow groundwater flow has been toward the north in the northernmost portion of the site; generally toward the south, southwest, and southeast beneath a majority of the site; and downward from the shallow zone into deeper groundwater intervals throughout the site vicinity. WDNR correctly concludes that there is not significant lateral movement of shallow groundwater containing VOCs in the site vicinity, as hydraulic gradients are strongly downward (Schmoller Dep. 2012, pp. 39-40). The limited extent of PCE and other VOCs in shallow groundwater is also directly related to the low rates of groundwater flow and contaminant migration through sediments and bedrock aquifers in the site vicinity. Based on these findings, the passage of time from well before 1994 to the present has not resulted in the need for increased remedial actions for the shallow groundwater.

Based on documented values of hydraulic conductivity, effective porosity, and measured hydraulic gradients, groundwater flow in the Unconsolidated Aquifer and Upper Bedrock Aquifer is generally downward (vertically) at calculated flow rates of only 1 to 36 ft per year (ft/yr). Rates of PCE migration in groundwater would be even lower, as PCE is known to be retarded in sediments and moves slower than the rate of groundwater flow (USEPA 2009). It is my conclusion that shallow groundwater containing PCE is not continuing to migrate or expand onto neighboring properties, and that the extent of PCE in shallow groundwater is essentially the same as that found in 1994 or before. This opinion is based on directions of groundwater flow, the limited extent of PCE and other VOCs in shallow groundwater, the fact that PCE was not detected in off-site wells (MW-7, MW-8, MW-10S and MW-11S), and the very stable PCE concentrations that have been observed in shallow groundwater at the site since at least 1994.

Groundwater sampling results indicate that PCE-impacted shallow groundwater is not present beneath residences beyond the area immediately surrounding Madison-Kipp. WDNR has also correctly concluded that contaminated shallow groundwater associated with the Madison-Kipp site is not believed to be present south of Atwood Avenue (Schmoller Dep. 2012, p. 90).

Deep Groundwater

The estimated rate of groundwater movement in the deep aquifer is as much as approximately 30 ft/yr (Bradbury et al. 1999). Based on this rate of flow, deeper groundwater containing PCE would have migrated no more than approximately 540 ft in a northerly or southerly and downward direction, since it was first discovered in 1994. It is my opinion that deeper groundwater containing PCE has had no impact on neighboring properties, as there is no use of that deeper groundwater at the site or in the immediate residential area surrounding Madison-Kipp, and VOC-impacted deeper groundwater is not a source of vapor intrusion. As to whether the extent of PCE in the deep groundwater has been defined for the purposes of selecting remedial actions, I understand that further investigations will be done that may impact the selection and/or scope of additional remedial measures that may be needed to augment the use of in-situ chemical oxidation (ISCO) as the primary remedy for groundwater (see discussion in Opinion 4 that this does not present or threaten an imminent and substantial endangerment to health or the environment).

2.3.1.5 Remediation

Technologies

Multiple technologies and approaches are available to remediate PCE and other VOCs in subsurface soil and groundwater, including ISCO, in-situ bioremediation, thermal treatment, surfactant/co-solvent flushing, groundwater extraction and treatment, and natural attenuation (Interstate Technology & Regulatory Council [ITRC] 2004, 2009; McGuire et al. 2006; State Coalition for Remediation of Dry Cleaners [SCRDC] 2007; USEPA 2004, 2009). Each of these technologies and approaches has been applied with varying degrees of success at VOC-impacted sites throughout the United States. A comprehensive 2007 study of more than 100 PCE-contamination sites by the SCRDC indicated that soil vapor extraction was the most widely used remedial technology for soils, and that ISCO and in-situ bioremediation were the most widely used groundwater remedial technologies (SCRDC 2007).

Prior Remedial Actions at Madison-Kipp

Several phases of on-site groundwater remediation have been completed at the Madison-Kipp site to address soil and shallow groundwater. Recent pilot tests have also been conducted to assist in design of an in-situ remediation system to further address VOCs in groundwater (ARCADIS 2012t). Contrary to assertions by Plaintiff expert, Dr. Lorne Everett, no further investigations are warranted to address soil or shallow groundwater. WDNR has also correctly concluded that further site investigations are not needed to make decisions about shallow groundwater remediation at the site (Schmoller Dep. 2012, p. 76).

Remedial actions previously implemented at the site include in-situ treatment of VOCs in soil and groundwater using chemical oxidation and SVE. ISCO was successful in reducing VOC concentrations in soils at multiple locations, and SVE has effectively removed substantial quantities of VOCs from soil and shallow groundwater. Investigations have also confirmed that natural attenuation is also occurring at the site, indicated by the presence of PCE degradation products and generally decreasing concentrations of PCE with depth and distance from on-site source areas.

In-Situ Chemical Oxidation

Based on evaluation of possible remedial alternatives, ISCO was selected as the most appropriate technology to treat PCE and other VOCs in groundwater (ARCADIS 2012t). Some technologies, such as groundwater extraction and treatment (GWET) were eliminated from consideration due to lack of effectiveness.

In-situ treatment of groundwater contaminants using ISCO is a proven technology that is much more efficient and effective than GWET in remediating VOC-impacted groundwater (ITRC 2004, 2009; USEPA 2004). In-situ treatment technologies, such as ISCO, have proven to be effective in remediating VOCs in groundwater to remedial goals at sites, such as the Madison-Kipp site, within a short period of time of one to two years. In contrast, GWET may require many decades to achieve significant improvement in groundwater quality (ITRC 2004; USEPA 1994). This is why WDNR has indicated that it does not expect groundwater pumping to be an option for remediation at this site (Schmoller Dep. 2012, p. 46). Instead, WDNR agrees that in-situ treatment and continued natural biodegradation is the most likely remedial approach for this site, and that this approach should be successful in reducing VOC levels to maximum contaminant levels (MCLs) within two decades (Schmoller Dep. 2012, p. 46, 51).

A pilot study of ISCO is currently underway to evaluate the use of this technology as a component of the final remedial plan for the site (ARCADIS 2012t). In-situ treatment of dissolved VOCs in groundwater effectively destroys or transforms the contaminants to non-hazardous compounds, often within months. In the 2007 SCRDC study, ISCO and bioremediation were found to be the most effective and successful technologies in achieving regulatory site closure at PCE contamination sites (SCRDC 2007). The same study reported that groundwater pump and treat was widely criticized as inefficient and too expensive as a groundwater remediation technology (SCRDC 2007).

Final Site Remediation

The groundwater remediation pilot test currently underway will provide information to assist in design and implementation of the remedy for shallow and deep groundwater. The final groundwater remedial system for PCE and any other contaminant will depend on the results of this pilot test and ongoing groundwater monitoring. I also understand that further investigations will be done that may impact the selection and/or scope of additional remedial measures that may be needed to augment the use of ISCO as the primary remedy. Ongoing remedial actions at the site involving SVE, in-situ treatment, and ongoing natural attenuation will continue to reduce dissolved-phase VOC concentrations. Remedial actions at the site will continue until WDNR-approved remedial action objectives are achieved. It is expected that the final approved cleanup levels for the site will also rely on ongoing natural attenuation processes that will continue to reduce VOC concentrations with time after source removal. Regardless, remedial actions will be conducted to achieve levels protective of health and the environment, all under the oversight of the WDNR.

2.4 Expert Opinion 4

Releases of PCE and other constituents from the Madison-Kipp facility do not present or threaten an "imminent and substantial endangerment to health or the environment."

2.4.1 Summary of Bases for Opinion

2.4.1.1 Legal Standard

I have been instructed as to the following legal standards for the Resource Conservation and Recovery Act (RCRA), and provide my opinions based upon these standards.

RCRA Section 6972(a)(1)(B) permits a private party to bring suit only upon a showing that the solid or hazardous waste at issue "may present an imminent and substantial endangerment to health or environment." 42 United States Code § 6972(a)(1)(B). I understand that the U.S. Supreme Court has held: "To be imminent, a threat must be present now, although the impact of that threat may not be felt until later." Meghrig v. KFC Western, Inc., 516 U.S. 479 (1996).

The *Meghrig* Court further held:

> *The meaning of this timing restriction is plain: An endangerment can only be 'imminent' if it "threaten[s] to occur immediately," Webster's New International Dictionary of English Language 1245 (2d ed. 1934), and the reference to waste which "may present" imminent harm quite clearly excludes waste that no longer presents such a danger.* Meghrig v. KFC Western, 516 U.S. 479, 485-86 (1996).

As to a substantial danger, the threat must be serious and there must be some necessity for the action.

I understand that courts will not find that an imminent and substantial endangerment exists if the risk of harm is remote in time, completely speculative in nature, or de minimis in degree. In other words, if there is no near-term threat, there is no imminent endangerment.

2.4.1.2 Site Conditions

Soil, Soil Vapor, and Shallow Groundwater

As previously discussed, it is my opinion that the extent of contamination in soil, soil vapor, and shallow groundwater has been defined, is limited, and that appropriate remedial actions have been or will be implemented to address this contamination. It is my opinion, based on these findings, the reports of other experts (Dr. Barbara Beck [Beck 2013] and Nadine Weinberg [Weinberg 2013]), and the legal standard set forth above, that releases of PCE or other constituents from Madison-Kipp do not present or threaten an imminent or substantial endangerment to health or the environment.

Because the low rates of groundwater flow and contaminant migration at the site have limited the extent of migration from the site in shallow groundwater, remedial actions being tested currently at the site are expected to be effective in remediating VOC-impacted shallow groundwater. Although the scope of the groundwater remedy may be somewhat greater than if such a remedy could have been implemented in 1994, the application of in-situ treatment technology was not yet documented to be a proven and effective technology to address groundwater at that time, as it is today. It is also my opinion that additional PCE migration that may have occurred during the period since 1994 has not substantially changed the overall scope and effectiveness of the shallow groundwater remedy given the low rates of shallow groundwater flow and contaminant migration.

Ongoing remedial actions, including SVE, in-situ treatment, and natural attenuation, will continue to reduce dissolved-phase VOC concentrations in groundwater. These remedial actions at the site will continue until WDNR-approved remedial action objectives are achieved.

Deep Groundwater

There is no groundwater use in the residential area and immediate site vicinity. The deep groundwater is not a source of sub-slab soil vapors. Furthermore, PCE has not been detected in City of Madison Unit Well 8, the closest water supply well, located approximately 1,500 ft southeast of the site. Unit Well 8 is 774 ft deep and obtains water from the Lower Bedrock Aquifer. This well, which is used only seasonally, has protective casing and an annular seal extending from the surface through the Eau Claire Aquitard, isolating the Lower Bedrock Aquifer from shallow sediments (Ruekert/Mielke 2011). The Eau Claire Aquitard provides an important barrier to possible vertical movement of contaminants into the Lower Bedrock Aquifer that might be present in the overlying Upper Bedrock Aquifer. Only trace levels of cis-1,2-dichloroethylene (cis-1,2-DCE) have been detected in Unit Well 8, and the City has identified 51 known or potential sources of contamination in the vicinity of the well, including sanitary sewers, industrial sites, AST and underground storage tank (UST) sites, spill sites, landfills, solid waste sites, electrical transformers, remediation sites, RCRA sites, road salt use, and the use of pesticides and herbicides throughout the area.

PCE is commonly found in groundwater in urban areas, as a result of the continuing widespread use of PCE in dry cleaning and other industrial uses. Monitoring by the City of Madison has detected PCE in multiple water supply wells (Madison Water Utility 2012). Recent studies by the U.S. Geological Survey (USGS) have documented that PCE and other VOCs are widespread and commonly present at low concentrations in groundwater in urban areas (Lawrence Livermore National Laboratory 2005; USGS 2009). Although commonly used laboratory reporting limits for VOCs may not detect PCE in groundwater, using much lower detection limits, the USGS found that PCE was commonly present in groundwater samples in urban areas.

Routine groundwater monitoring of Unit Well 8 conducted by the City of Madison provides the city an early warning of possible contamination impacts to that well by any contaminant, from any source. PCE has never been detected in Unit Well 8. Even if PCE were to be detected in Unit Well 8, in my experience such detections (which would be at extremely low levels) would provide sufficient time (i.e. at least several years) in which appropriate remedial actions could be taken, if warranted, before actionable levels were present in the well. Therefore, even if the City of Madison detected PCE in Unit Well 8 tomorrow, there would be enough time for appropriate remedial actions to be taken, such that there would be no threat of an imminent and substantial endangerment to health or the environment.

My opinion is supported by hydrogeologic conditions, the low rates of migration of VOCs in groundwater, groundwater remedial actions that are currently being or will be implemented, the lack of detection of PCE in the closest water supply well, the depth of that water supply well, and the presence of natural barriers to contamination. It is also my understanding that any remediation that may be required with respect to the deep groundwater will be undertaken to address PCE or other VOCs that are related to Madison-Kipp in the deep groundwater.

2.5 Rebuttal Responses to Opinions of Plaintiff Expert, Dr. Lorne Everett

Following are rebuttal responses to certain opinions of Plaintiff's expert, Dr. Lorne Everett. It should be noted that review of Dr. Everett's expert report is ongoing and additional rebuttal responses may be provided at some future date.

> Dr. Everett suggests that "In the technical literature, the presence of TCE….in the environment was noted as early as 1949 by Lyne and McLachlan. The article, published in The Analyst published by the Royal Society of Chemistry (London), describes two cases of groundwater contaminated by TCE…. The publication concluded that 'contamination by compounds of this nature is likely to be very persistent'." (Everett 2012, p. 23)

Dr. Everett neglects to mention, however, the comprehensive study of the historical context and influence of 1949 Lyne and McLachlan's article by Rivett et al. in 2006 (Rivet et al. 2006). Rivett et al. (2006) concluded that this article received very little notice at the time, as the authors were conducting a very limit study for local authorities and, as such, it was unlikely that trichloroethene (TCE) would have become an emerging issue in the United Kingdom (UK) or elsewhere. This article was reportedly not cited at all in the 1970s and 1980s literature describing increasing concerns in the United States and Europe regarding solvents in groundwater, and was not cited in the UK until 2000. Rivett et al. (2006) concluded that the 1949 Lyne and McLachlan article did not result in any awareness of the problem of TCE (or other chlorinated solvents) in groundwater at the local, national, or international levels. Furthermore, Rivett et al. (2006) concluded that the results of the 1949 study did not trigger any general recognition of this problem by the scientific, engineering, or regulatory community.

Consistent with my personal experience in the environmental industry during the last 37 years, there was not general recognition of the problem of solvents (such as PCE) in groundwater until the late 1970s and early 1980s (Rivett et al. 2006). The study by Rivett et al. (2006) of the history of awareness of chlorinated solvent in groundwater, indicated that there were almost no publications that confirmed solvent concentrations in groundwater in the United States before 1975.

It was not until the mid- to late 1970s, after the discovery of chloroform and other trihalomethanes in drinking water supplies resulting from chlorination, that USEPA surveys and other local studies revealed the contamination by chlorinated solvents, leading to the conclusion between 1976 and 1979 that groundwater in many areas of the United States was contaminated by chlorinated solvents (Pankow and Cherry 1996; Rivett et al. 2006). This is consistent with studies I have personally conducted regarding the historical discovery of chlorinated solvents, including PCE and TCE, in groundwater (Johnson 2003; Johnson and Nichols 2002).

> Dr. Everett suggests that “When a regulatory agency requires a responsible party to “determine the horizontal and vertical extent of contamination.” This typically means conducting sampling programs until non-detects are found and the true edge of the contaminant plumes can be mapped out.” (Everett 2012, p. 46)

This statement is incorrect. In my 37 years of experience working on hundreds of sites, regulatory agencies typically do not require sampling and definition to non-detect levels. The actual levels used to define the extent of contamination vary depending on the location and the chemical. However, concentration levels, such as drinking water MCLs, are commonly used to define the extent of contamination.

> Dr. Everett suggests that “Manmade structures such as buried utility lines and sewers can serve as preferential pathways for contaminant migration in the subsurface.” (Everett 2012, p. 39)

In my opinion, there is no evidence that preferential pathways, such as utility corridors, sanitary sewers, and storm drains, have influenced contaminant migration in the site vicinity. This opinion matches WDNR’s conclusion that soil vapor and groundwater sampling data do not indicate that contaminant migration has occurred through preferential pathways (Schmoller Dep. 2012, p. 69). For example, WDNR concluded that the sanitary sewers along South Marquette Street and Waubesa Street are oriented north-south and do not provide a pathway from the Madison-Kipp facility (Schmoller Dep. 2012, p. 70). Because WDNR has determined that there is no evidence of contamination related to sewer lines, WDNR has no plans to investigate sewers or utilities as preferential pathways for contaminant migration (Schmoller Dep. 2012, pp. 70-71).

> Dr. Everett suggests that PCE "likely infiltrated into the groundwater in a "free product" or DNAPL (dense non-aqueous phase liquid…". He also suggests that "the 1% rule" (referring to the comparison of the dissolved concentration of a compound in groundwater with the aqueous solubility of the compound) indicates the presence of DNAPL in the subsurface. (Everett 2012, p. 47)

There is no direct evidence of dense non-aqueous phase liquid (DNAPL) in subsurface soil or groundwater at the site. DNAPL has not been encountered from any of the more than 100 soil borings and monitoring wells at Madison-Kipp. WDNR has also concluded that there is "no indication" of DNAPL, and that no DNAPL is present at the site (Schmoller Dep. 2012, p. 115).

There are indirect methods for assessing whether PCE or other chemicals in soil and groundwater are present as non-aqueous phase liquids (NAPL) (Cohen et al. 1992; Feenstra et al. 1992; ITRC 2004; USEPA 2009). In soil, concentrations of chemicals exceeding 1 percent of the soil mass (above 10,000 milligrams per kilogram [mg/kg]) have been reported as generally indicative of the possible presence of NAPL (Feenstra et al.1992; USEPA 1992). The highest concentration of PCE in soil at the Madison-Kipp site is 5,000 mg/kg, less than half of the concentration suggestive of NAPL presence (ARCADIS 2013b).

For groundwater, comparison of chemical concentrations in groundwater with the aqueous solubility of the chemical was developed as a "rule of thumb" (USEPA 1992), and not a "fixed rule," as suggested by Plaintiffs' expert, Dr. Everett, indicating the presence of NAPL. Multiple studies of NAPL occurrence indicate that, where present as a separate phase, DNAPL compounds are generally present at concentrations less than 10 percent of their aqueous solubility limit in groundwater samples (Cohen et al. 1992; Cohen and Mercer 1993; United Kingdom Environment Agency 2003; USEPA 1993a, 1994). The aqueous solubility of PCE is reported to be as high as 200,000 micrograms per liter (µg/L) (Cohen et al. 1992). The PCE concentration in water corresponding to 10 percent of this solubility would be 200,000 µg/L. The highest PCE concentration detected in groundwater at the Madison-Kipp site is only 9,400 µg/L (ARCADIS 2013b). In my experience, chemicals often occur in groundwater plumes at concentrations above 1 percent of the chemical's solubility, and do not indicate that NAPL is present in the nearby groundwater. Additionally, due to the qualitative nature and uncertainty of these "rules of thumb" and the inherent variability of subsurface conditions, the USEPA has found in a review of multiple site investigations that this criterion rule was "indeterminate at best" for DNAPL delineation, and that "…the 1% solubility rule of thumb was therefore not a good estimator…" at some sites (USEPA 2004).

Pankow and Cherry, in their textbook *Dense Chlorinated Solvents* (Pankow and Cherry 1996) indicate that this 1 percent "rule-of-thumb…should not be viewed as a strict criterion" because the dissolved concentrations in a monitoring well depend on factors other than the presence or absence of DNAPL source zones. Therefore, they indicate that the use of a 1 percent rule of thumb to assess DNAPL presence "could be an extreme overestimate" (Pankow and Cherry 1996).

> Dr. Everett presents a suggested remediation program for soil, soil vapor, and groundwater "at and around the Madison-Kipp Site" (Everett 2012, pp. 56-59)

The remediation program suggested by Dr. Everett is not supported by the facts and extensive data from the site area. While his suggested remediation technology for VOCs is appropriate for on-site soils, which are effective in controlling VOC off-site migration in soils, there is no basis for further remediation of VOCs in off-site soils. Furthermore, as concluded by WDNR, sampling data indicate that no further remediation or mitigation is required to address off-site VOCs.

For groundwater, Dr. Everett does correctly conclude that ISCO for groundwater remediation is "probably appropriate"; however, he provides unsupported speculation regarding the number and depths of injection locations that will be needed. Pilot tests are underway to determine the scope of this groundwater remedy, and the depths and locations of ISCO injection will be determined based on the results of that testing, ongoing groundwater monitoring results, and WDNR review.

Dr. Everett's incorrectly suggests that groundwater extraction and treatment be included as a component of the groundwater remedy. Groundwater monitoring data indicate that the extent of VOCs in shallow groundwater is defined for the purposes of selecting remedial actions. Based on those monitoring data and concurrence from the WDNR, in-situ treatment technology is being evaluated in pilot tests as the remedial approach for shallow groundwater. Due to the limited extent of VOCs in groundwater and the low rates of groundwater movement at the site, groundwater extraction and treatment is not warranted for shallow groundwater. I understand that further investigations will be done that may impact the selection and/or scope of additional remedial measures that may be needed to augment the use of ISCO as the primary remedy for groundwater.

> Dr. Everett suggests that environmental managers at Madison-Kipp did not have "environmental training", and as a result they did not have the necessary "training and authority" to address environmental matters at the site. (Everett 2012, p. 24)

My experience indicates that industrial facility managers and employees have generally been facilities specialists, not trained environmental engineers. Also, it has been my experience that these facilities managers and employees relied on industry guidance and local regulations in the use of equipment and waste disposal activities, and were not trained environmental engineers. When needed, Madison-Kipp hired engineering and environmental professionals to address more complex technical issues.

> Dr. Everett incorrectly suggests that Madison-Kipp has not been "responsive" to WDNR in the environmental investigation and cleanup process. (Everett 2012, p. 31)

The interactive process between WDNR and responsible parties, such as Madison-Kipp, involves submittal of work plans and reports by the responsible party (Madison-Kipp) for review and approval by the WDNR. It is typical for there to be differences in technical interpretation and occasional disagreements regarding various aspects of these plans and reports. The WDNR cannot unilaterally direct the responsible party how to perform specific work tasks, but relies on the process whereby the responsible party and their environmental consultant negotiate the appropriate actions. Additionally, in 1994 immediately following receipt of the July 1994 letter from WDNR requiring on-site investigations of possible VOC releases, Madison-Kipp also evaluated the possibility that VOCs in groundwater may have originated from other nearby off-site industrial facilities. In my 37 years of experience, this is not only a common step; it is a necessary step in evaluating the occurrence of groundwater contamination. Furthermore, the WDNR project manager, Michael Schmoller, has concluded that Madison-Kipp did not intend to make "someone else" responsible for the contamination discovered in 1994 (Schmoller Dep. 2012, p. 212).

> Dr. Everett incorrectly suggests that it is "unusual" for a company's attorney to attend every meeting with regulating agency representatives. (Everett 2013, p. 35)

In my experience, it is common for attorneys for a potentially responsible party to be present at every meeting with regulating agency representatives.

3. Signature Page

Appendix C to this report presents a copy of my current Curriculum Vitae, a list of publications that I have authored in the past 10 years, and a list of cases in which I have provided expert testimony during the past four years. My employer, ARCADIS U.S., Inc., (ARCADIS), charges $345 per hour for my time on this project.

Thomas M. Johnson, P.G., C.HG.
Executive Vice President, Technical Director
and Principal Hydrogeologist
Wisconsin Professional Geologist No.

January 21, 2013
Date