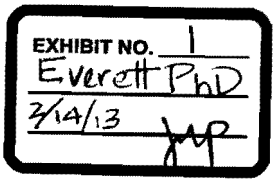


# Expert Report
# of
# Lorne G. Everett, PhD, DSc

*L. Everett & Associates, LLC*

In the matter of:

**Kathleen McHugh and Deanna Schneider, et al.**

**v.**

**Madison-Kipp Corporation, et al.**

**December 3, 2012**

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# Lorne G. Everett, PhD, DSc.

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In the matter of:

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**v.**

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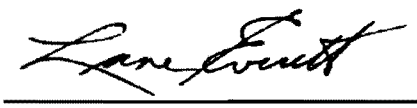
I declare under penalty of perjury that the following is true and correct, to the best of my information and belief. Executed on December 3, 2012 at Santa Barbara, California.



Lorne G. Everett, PhD, DSc.
L. Everett & Associates, LLC

# Section 1. Introduction

I have been retained by the law firms of Varga Berger Ledsky Hayes & Casey and The Collins Law Firm on behalf of Kathleen McHugh and Deanna Schneider, et al. to provide scientific input and expert opinions concerning soil, soil gas, groundwater and vapor/air contamination in and around the Madison-Kipp facility in Madison, Wisconsin.

In this report, I have described my opinions and the bases for these opinions. I have relied upon my education and experience in environmental science and hydrology to form my opinions in this expert report. I have also relied upon data and documents that were prepared by others concerning the site and the neighborhood. The documents relied upon include those listed in Section 3 of this report and were reviewed by myself or other staff at L. Everett & Associates, under my direction. In addition to those documents explicitly referenced in this report, we have also reviewed deposition transcripts and thousands of pages of documents included in DNR's state electronic document repository for cleanup sites. Further, I have relied upon reference texts accepted and held reliable by experts in the fields of environmental science, environmental engineering, and hydrogeology as well as generally-accepted principles in those fields. I have also personally inspected the Madison-Kipp facility and the neighboring Class Area. If additional relevant information becomes available, I reserve the right to revise my opinions. I may also provide supplemental opinions regarding this case, if requested. In addition to the exhibits included herein, figures, tables and maps included in references cited in this report may be used as trial exhibits. References to evidence in the form of testimony or documents or data are not meant to be exhaustive but rather exemplary. There are other documents and data in the voluminous case file that also support the opinions offered herein. The opinions described in this report are made to a reasonable degree of scientific certainty.

### Background and Qualifications for Lorne G. Everett

I, Lorne G. Everett, Ph.D., DSc., PH, PH-GW, CGWP wrote this Expert Report in the matter of Kathleen McHugh, and Deanna Schneider et al v. Madison-Kipp et al. I have personal knowledge of the matters stated herein. If called as a witness, I could and would competently testify to the matters set forth in this report. Currently, I am Chief Scientist and CEO of L. Everett & Associates, LLC.

I have been retained to provide opinions relative to the distribution of PCE, PCB, PAHs and other volatile organic compounds (VOCs) in soil, soil gas, groundwater and vapor/air, vadose zone contaminant behavior, groundwater hydrology, hydrogeology, environmental investigations, site characterization and remediation.

I am a retired Research Professor/Hydrologist (Level VII) in the Donald Bren School of Environmental Science and Management at the University of California at Santa Barbara. The University of California has reserved Level VII for "scholars of great distinction."

I am a Fellow of the American Society of Civil Engineers (ASCE), a Fellow of the American Water Resources Association (AWRA), and a Fellow of the American Society for Testing and Materials (ASTM). The Title Fellow recognizes the highest earned honor bestowed by a Professional society.

I have a Ph.D. in hydrology (1972) from the University of Arizona. I am a registered hydrologist, #164, and a registered hydrogeologist #836, with the American Institute of Hydrology. I have served on the Board of Registration for the American Institute of Hydrology. I am a Certified Groundwater Professional, #293, by the American Association of Groundwater Scientists and Engineers. Lastly, I am a former Registered Environmental Assessor II, by the California Environmental Protection Agency, Department of Toxic Substances Control. DTSC declared that the REA II registration was the highest environmental registration recognized in the State of California.

I am the Past Director of the Vadose Zone (Soils) Monitoring Laboratory at the University of California. For over 15 years I directed leading edge research on liquid and gaseous migration in both the saturated and unsaturated (vadose) zone.

For 18 years I have been the Charter D18.21.02 Chairman of the American Society for Testing and Materials (ASTM) task committee on Vadose Zone Monitoring. I was a centennial member of the ASTM Board of Directors and received the ASTM, Award of Merit, the highest honor bestowed by the society for writing National Groundwater and Vadose Zone Standards. As chairman of ASTM's Vadose Zone Task Committee, I was responsible for developing all of the current national ASTM D18.21.02 Vadose Zone standards. I have received ASTM Standards Development Awards including the award for Comparison of Field Methods for Determining Hydraulic Conductivity and the Standards Development Award for the Standard Guide for Pore-Liquid Sampling. I received the A. Ivan Johnson Outstanding Achievement Award in 1997 for "Outstanding and Significant Contributions" to the hydrogeologic understanding of soil and rock.

Of direct relevance to soil gas sampling and vapor intrusion issues in this case, I Chair the ASTM committee (D18.21.02) which developed the following soil gas monitoring national standards:

- D5314-92 (2006) Standard Guide for Soil Gas Monitoring in the Vadose Zone
- D7758 (2011) Practice For Passive Soil Gas Sampling in the Vadose Zone for Source Identification, Spatial Variability Assessment, Monitoring, and Vapor Intrusion Evaluations
- D7648 (2012) Practice For Active Soil Gas Sampling for Direct Push or Manual-Driven Hand-Sampling Equipment
- D7663 (2012) Practice for Active Soil Gas Sampling in the Vadose Zone for Vapor Intrusion Evaluations

Further on January 30, 2013, I will chair an international ASTM symposium entitled: Continuous Soil Gas Measurements: Worst-Case Risk Parameters. This symposium is directly related to the vapor intrusion issues in this case.

In 1996, I received a Doctor of Science Degree (Honoris Causa) from Lakehead University in Canada for Distinguished Achievements in Hydrology. In 2002 I received the C. V. Theis Award, the highest award given by the American Institute of Hydrology (AIH) for major contributions to groundwater hydrology.

I have authored, edited, and contributed chapters to over 12 books, published over 150 professional papers and reports, hold several patents, and developed numerous standards on the subject of groundwater and vadose zone characterization and remediation. My book entitled "Groundwater Monitoring" was endorsed by the EPA as "establishing the State of the Art used by industry today" and was recommended by the World Health Organization for all developing countries. I was an invited Charter member of the Editorial Board of the journal, Environmental Forensics, a quarterly peer-reviewed scientific journal of national and international circulation. In this role, I evaluated the work of others through peer-review of manuscripts submitted for publication to the journal. I also participated in publication decisions, as well as establishing and maintaining the editorial direction of the journal.

For my contributions to the science of hydrogeology I was elected (No. 300-H3) to the Russian Academy of Natural Sciences. Based upon my original contributions to the science of hydrogeology, I received the Russian Academy's highest honor entitled the "Kapitsa Gold Medal". The Medal was presented by the Head of the Russian Academy's Water Problems Institute, on October 29, 1999 at the Beau Rivage Palace in Lausanne, Switzerland in front of an audience Chaired by Nobel Laureates.

My book entitled "Subsurface Migration of Hazardous Waste" is widely used in contamination investigations. With the Russian Academy, I was the English editor of a 2002 book entitled Groundwater

and the Environment-Applications for the Global Community. My book entitled "Vadose Zone Monitoring for Hazardous Waste Sites" has been sold out. My book entitled, "Handbook of Vadose Zone Characterization and Monitoring" has been deemed a best seller by Lewis Publishers. As a tribute, the United States Department of Energy (DOE) in 1999, asked me to endorse their book entitled "Vadose Zone Science and Technology Solutions. DOE further asked me to frame the research needs of the book and to write the Foreword (I), Forward (II) was written by Dr Paul A. Witherspoon, UC Berkeley. My endorsement appears on the back cover of the 1540 page, two-volume book.

Based upon my many years of experience, I have participated on the Executive Committee of the United States Department of Energy's DOE Complex Wide Vadose Zone Science and Technology Roadmap.

As a further part of my contributions to federal agencies, I was a charter member of the Science Advisory Board of the United States Department of Defense (DOD) National Environmental Technology Test Site. For my contributions to the science advisory board on petroleum characterization and remediation, I received the United States Navy's Medal of Excellence in October, 1999.

I am a member of the Lawrence Livermore National Laboratory "peer review" team (led by a member of the National Academy of Sciences) for the LLNL investigation entitled: "Historical Case Analysis for Chlorinated Volatile Organic Compound Plumes". This was the largest data-base on chlorinated hydrocarbons, ever assembled and analyzed.

I am a co- author of the Lawrence Livermore National Laboratory reports entitled; "California Leaking Underwater Fuel Tank (LUFT) Historical Case Analysis" and "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks". This was the largest analysis of petroleum hydrocarbon migration characteristics that has ever been undertaken.

I am on the EPA/DOE/DOD/NASA Technical Advisory Board for the national evaluation of DNAPL chlorinated hydrocarbon cleanup technologies held at Launch Complex 34 at the NASA Kennedy Space Center. The most promising 10 DNAPL chlorinated hydrocarbon remediation technologies were evaluated for effectiveness and costs and 3 were demonstrated at Complex 34.

I was on the US Navy "Gatekeeper Review Panel" which evaluated the latest research on chlorinated hydrocarbon characterization and remediation.

At the request of UNESCO in Paris, I was the English editor of a Monograph entitled Groundwater Resources of the World and Their Use. The Monograph published in 2004 looks at drinking water issues

throughout the World and was distributed by UNESCO to every water resources research centre in the World. The US National Association of Groundwater Scientists and Engineers published a second printing of the book in 2006. The book was translated into Russian and reprinted by the Russian Academy of Sciences in 2007.

On behalf of EPA/DOE/DuPont I co edited a State of the Art book entitled: Barrier Systems for Environmental Contaminant Containment and Treatment that was released in 2006 by CRC press.

For the past 24 years I have been continuously invited by Dr Antonio Zichichi, a Science Advisor to the Pope, to participate in Planetary Emergency meetings held in southern Italy wherein I am the Chairman of the World Federation of Scientists Pollution Panel. In the fall a second meeting is often held at the Pontifical Academy of Sciences in the Vatican.

For over three decades I have been involved in consulting and advising the US Department of Energy on environmental issues. I have peer reviewed, visited, consulted, lectured, and been an advisor at the following DOE sites: Lawrence Livermore National Laboratory, Hanford Washington, Rocky Flats Colorado, Idaho National Engineering Laboratory, Fernald Ohio, Paducah, Kentucky, Savannah River, Argonne National Laboratory and DOE Headquarters in Washington DC. I have been on DOE Roadmap committees as a member and Executive reviewer. I have been a DOE trainer and author of DOE supported environmental documents.

I have given mock trial training programs to environmental lawyers at the invitation of Carmen Trutanich Esq., the current Los Angeles City Attorney.

From 2000 -2009 I was the Chancellor of Lakehead University in Thunder Bay, Ontario, Canada. For my contributions to Canada, I received the Gold Medal from the Governors General of Canada in 2002.

I have given invited court room training to the Environmental Protection Agency, Criminal Investigation Division. My Criminal Investigation Division award states: "For your invaluable support and notable contribution to the mission of the Criminal Investigation Division".

A complete copy of my resume is provided as Attachment A of this report. I have relied upon my education and experience in environmental science and hydrology and my experience in soil moisture migration and vadose zone monitoring to form my opinions in this expert report. I have also relied upon data and documents that were prepared by others concerning the area in discussion. I reserve the right to

supplement or modify this report and my opinions to respond to any new or additional information that may become available after the date of this report.

For preparing this report, L. Everett & Associates invoices my time at the rate of $400/hr. For deposition and trial testimony my hourly rate is $800. My opinions are summarized below and discussed in more detail in Section 2 of this Expert Report.

**Summary of Opinions**

This is a case in which hazardous waste disposal and chemical handling practices at an industrial facility in Madison, Wisconsin have caused soil, soil gas, groundwater and vapor/air contamination with harmful chemicals. The contamination has migrated on the ground surface and in the subsurface and now extends throughout the Class Area and beyond. Some of the contaminants are a class of chemicals called volatile organic compounds (VOCs). These chemicals volatilize from the soil and groundwater. The contaminated soil gas then migrates upward and infiltrates overlying structures causing contamination of indoor air. Further, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and metals are extensively found both onsite and in the neighboring Class Area yards. While much of this contamination resulted from dumping and spills which occurred several decades ago, meaningful investigation of the extent of the contamination has been undertaken only within the last year. Those remedial activities that have been conducted to date have been ineffective at removing, or have simply neglected to remove, Madison-Kipp's contaminants both from its property and from the neighboring properties of the Class Area. Residents of the Class Area have already been exposed to Madison-Kipp's toxic chemicals for decades; the net result of the delays and flaws in the environmental program is that the residents face many more years, if not decades, of potential exposure.

Madison-Kipp has been releasing toxic chemicals for decades and (considering the contaminant transport mechanisms associated with this site) the migration of chemicals into the Class Area would have begun shortly after commencement of the releases. For example, contaminants spread by wind-blown transport and run-off would have migrated offsite as soon after the commencement of dumping as the first major rainstorm or windy day. Soil vapor migration from VOC-contaminated onsite soil would have reached the immediately adjacent homes in a matter of weeks or months. Considering an approximate shallow

groundwater flow velocity of 40 of feet per year[1], contaminated groundwater would have extended off-site within (at most) a year or two of first becoming impacted.

The historical record and testimony of Madison-Kipp employees shows that the company's initial strategy was to deny it had a problem and seek to redirect the blame to others. As the years went by and the fallacy of this message became more and more obvious, Madison-Kipp's strategy changed and it embraced a message for public consumption that its environmental problems were not serious. This message was also false, as the environmental testing, particularly within the last year, has proven the serious nature of the surface and subsurface contamination at this site and in the surrounding neighborhood.

I am providing the following opinions regarding environmental conditions at and near the Madison-Kipp Site. Section 2 of this report provides supporting information and the bases for these opinions. These opinions are reinforcing of one another. Documents, data and supporting evidence cited in one opinion are generally also relevant to others and are hereby incorporated.

**Opinion 1.** Chemical releases from Madison-Kipp are the source of the soil, soil gas, groundwater and vapor/air contamination in the Class Area and beyond.

**Opinion 2.** Madison-Kipp violated applicable standards of conduct in its handling, disposal and releases of hazardous chemicals.

**Opinion 3.** Madison-Kipp violated applicable standards of conduct in its failure to promptly and thoroughly investigate and remediate the contamination and protect the people and environment threatened by it.

**Opinion 4.** The soil, soil gas, groundwater and vapor/air contamination at and released from this Site and into the Class Area constitute an imminent and substantial endangerment to human health and the environment within the meaning of the Resource Conservation and Recovery Act (RCRA). The imminent and substantial endangerment will persist indefinitely unless effective remedial actions are implemented.

**Opinion 5.** Because Madison-Kipp has no comprehensive plan to complete the investigation or to clean up the contamination, and has failed to confront the complexity and challenges of remediating the

[1] This estimate is based on an average hydraulic conductivity of 7 ft/day and porosity of 20% (Ruekert/Mielke, 2011 on behalf of Madison Water Utility) and average gradient of 0.003 (RJN Environmental Services, 2011, Annual Report).

widespread contamination it has caused, additional remedial measures are required to characterize the site and mitigate the imminent and substantial endangerment to human health and the environment.

I have considered multiple lines of evidence in my approach to this matter as is accepted environmental practice. Further, I have personally documented conditions outside of the Madison–Kipp facility in Pictures 1 thru 36 in this report.

### Site Location and Description

Madison-Kipp, the "Site" is located at 201 Waubesa Street in Madison, Wisconsin. The location of the Site is illustrated on a topographic quadrangle presented as Exhibit 1. The Site is approximately 7.5 acres in size. The site was first developed for metal casting in the late 1800's and Madison-Kipp has operated a metals casting facility at the Site for many decades. The property consists of a 130,000-square foot building (which occupies much of the Site), surrounded by asphalt parking lots to the northeast, southwest and southeast of the main building. The building has a 25,000-square foot second floor and a 25,000-square foot basement. Exhibit 2 depicts the layout of the Site.

Although the Site is zoned M-1 (industrial/manufacturing), it is located in a mixed use area of commercial, industrial and residential land use of eastern Madison. The Site is bounded by a bicycle trail (Capital City Trail) to the north, Atwood Avenue to the south, Waubesa Street to the west and Marquette Street to the east. Residences are located directly adjacent to the Site on the east and west sides, and residences are also located further west (across Waubesa Street) and east (across Marquette Street). Commercial properties are located to the south (across Atwood Street) and further east. The Goodman Community Center is located to the north (across the Capital Trail).

The Site is situated at the northeast end of the Madison isthmus, approximately 1,500 feet north of Lake Monona and approximately 6,800 feet east of Lake Mendota. The topography of the Site is relatively flat, with an elevation ranging from approximately 870 to 880 feet above mean sea level. The Site and surrounding area is serviced by municipal water supply and sewage systems.

### Hydrogeologic Conditions

The Madison area lies in a part of Wisconsin underlain by a thick sequence of Paleozoic sedimentary rock that was deeply eroded during Pleistocene glaciations. In the vicinity of the Site, the bedrock surface lies beneath approximately 35 feet of unconsolidated glacial sediments. Clayton and Attig (1997) have mapped the glacial sediments in the area as a patchwork of glacial lake sediments (e.g. stratified sand, silt and clay) and till (much denser and poorly sorted gravelly, clayey silty sand). Soil borings completed at

the Site describe the unconsolidated zone as a fining-upward sequence consistent with lake sediments. The typical unconsolidated stratigraphy includes:

- A veneer of surficial fill, generally less than 5 feet thick.
- Clay or silty clay, from approximately 5 to between 10 and 15 feet below ground surface.
- Sand, from approximately 10 feet to the top of rock at approximatley 35 feet. The sand is typically fine-grained and variably silty, with occasional gravel beds, particularly in the bottom half of the unit.

While the sedimentary bedrock in the Madison area is nearly flat-lying, the bedrock surface was deeply eroded by glaciers. Lakes Mendota and Monona, located to the north and south of the Site, respectively, occupy deep glacial valleys that were scoured at least 200 feet into the bedrock (Bradbury and others, 1999)

The Site vicinity is underlain by approximately 750 feet of Cambrian-aged sandstone, shale and dolomite. The expected stratigraphy at the Site is as follows (Ruekert/Mielke, 2011).

| Estimated Depth | Formation/Group | Description |
|---|---|---|
| 35-120 feet | Tunnel City Group | Poorly to moderately-well cemented fine-to-medium sandstone, often Glauconitic (containing green/blue sand-sized clay nodules). |
| 120-245 feet | Wonewoc Formation | Medium to fine-grained sandstone |
| 245-430 feet | Eau Claire Formation | The upper part of contains significant shale and siltstone. Deeper, the unit is chiefly dolomitic sandstone |
| 430-750 feet | Mount Simon Formation | Well-cemented, coarse to medium-grain sandstone |

The hydrostratigraphy of the area is typically divided into four units:

- **Unconsolidated Zone (Upper Unconsolidated Aquifer)**, the zone of saturated glacial sediments overlying bedrock. In the vicinity of Madison-Kipp, this zone is discontinuous. The zone of saturation is thin to absent in the southern part of the Site (e.g., the water table is at or below the rock surface), to between 10 and 15 feet thick in the north of the Site. Typically, only the sandy portion of the unconsolidated zone is saturated, while the shallow clay is above the water table.

- **Upper Paleozoic Aquifer (Upper Bedrock Aquifer)**, encompassing the Tunnel City Group and Wonewoc Formation (approximately 210 feet total thickness). The unit is not used extensively for water supply, but is moderately permeable, with a hydraulic conductivity estimated at approximately 5 feet per day (Ruekert/Mielke, 2011).
- **Eau Claire Aquitard,** defined as the thin shaley facies found near the top of the Eau Claire Formation. Where present, this unit functions as an aquitard separating the Upper Paleozoic Aquifer from the Mt. Simon Aquifer below. The Eau Claire is present in the immediate Site vicinity, but is eroded in the glacial bedrock valleys beneath Lakes Monona and Mendota.
- **Mount Simon Aquifer (Lower Bedrock Aquifer),** defined as the Mount Simon and Eau Claire Formations, starting below the Eau Claire Aquitard (approximately 500 feet total thickness). The Mt. Simon Aquifer supplies the main water-supply wells. The mean hydraulic conductivity of the aquifer is estimated at approximately 10 feet per day (Bradbury and others, 1999).

Though the sandstone aquifers have moderate porosity (typically 10-20 percent), the groundwater flow occurs predominately in fractures such as bedding planes and joints. The porous matrix of the sandstone creates a secondary permeability, and provides a significant volume of storage.

The water table at the Site generally ranges between 15 and 35 feet below ground surface. Previous reports have shown shallow groundwater flow trending to the east and south; flow in the bedrock appeared to trend south, but has shown more variability than in the upper zones. Based on the groundwater levels measured from nested monitoring wells, there is a vertical gradient suggesting groundwater from the Site includes a downward flow component The PCB and PAH contamination would be found mostly in the veneer of surficial soil, thus is not likely impacting groundwater. PCE is found in shallow groundwater (in MW-5D, for example) in the Tunnel City Group. However, PCE has been detected as deep as 229.5 feet below ground surface at MW-3, which shows that the contamination extends into the underlying Wonewoc Formation.

# Section 2. Expert Opinions

**OPINION 1. Chemical releases from Madison-Kipp are the source of the soil, soil gas, groundwater and vapor/air contamination in the Class Area and beyond.**

Environmental testing at the Site demonstrates extensive contamination of soil, soil gas, groundwater and vapor/air in and around the Madison-Kipp Site with a myriad of what are known today as "hazardous wastes,"[2] including chlorinated volatile organic compounds, PAHs, metals and PCBs. These are "hazardous wastes" within the meaning of the federal law known as the Resource Conservation and Recovery Act (RCRA)[3]. To date, the most abundant chemical found in the subsurface is tetrachloroethene (PCE) a chlorinated solvent commonly used as an industrial degreaser. That Madison-Kipp is the source of this contamination on its site and in the surrounding Class Area is not subject to reasonable scientific dispute. The soil, soil gas and groundwater on company property is pervasively contaminated, and is literally just feet away from Class Area homes. As acknowledged by Madison-Kipp's environmental consultant, there are no other industrial operations in the Class Area that could be likely alternative sources of the PCE vapors (Trask Deposition, 2012, p. 158). After initial denials, Madison-Kipp and its consultants subsequently acknowledged this fact. Mr. Schmoller, the Project Manager for the State of Wisconsin Department of Natural Resources (WDNR) on the Madison-Kipp site, confirmed in his deposition that there is widespread PCE soil contamination at the Madison-Kipp site (Schmoller Deposition, 2012, pp. 105-106). Mr. Schmoller also confirmed that Madison-Kipp is the source of vapor contamination on Class Area properties when he stated that the source of vapors found at properties directly adjacent to the facility is Madison-Kipp (Schmoller Deposition, 2012, pp. 32-33).

The principal contaminant now invading the immediately adjacent Class Area, PCE, was first dumped and spilled on the Madison-Kipp property decades ago, as explained in this report. As there was no clean-up of the PCE, it was allowed to migrate through the soil layers, ultimately contaminating at least two subsurface groundwater aquifers which transport contamination into the Class Area.

[2] 42 USC §6903(5).
[3] 42 USC §6901, et sec.

The contaminated groundwater which then migrated from the Madison-Kipp site and spread throughout the Class Area contains PCE concentrations as high as 4,600 ug/l. This contaminated groundwater then contaminated the soil, soil vapor and air above it (including air beneath and inside homes) in the Class Area in two basic ways. First, fine-grained sediments cause the contaminated groundwater to "wick up," similar to an ink blotter wicking up ink, and by this method contamination moves from the water table to the soil underneath and surrounding the homes. Second, because the toxic chemicals in the groundwater evaporate (called "volatilization"), they move upward in a gaseous state through the soil and into the air above it. Some of the PCE now being found in vapor under neighborhood homes migrates laterally through the soil from the highly contaminated soil on Madison-Kipp property and some migrates vertically from underlying VOC-contaminated groundwater. This soil vapor contamination can seep through cracks and utility penetrations in floors and basements, resulting in the introduction of contaminated air into homes. Contamination also spreads into surficial soil by windblown dust, exhaust fallout and by sediment transport during rain and flooding events. The PAH, PCB and metal contamination spreads away from the Madison-Kipp property primarily by these methods. The PAHs, PCBs and metals now being found in neighbors' soil has migrated from the highly contaminated soil on Madison-Kipp property and/or has been discharged directly from Madison-Kipp's vents and stacks and contaminated particulate matter subsequently settled out of the air onto the neighbors' yards.

The contamination was ignored for many years after it was first dumped, spilled, etc. In 1994, it was identified to Madison-Kipp by WDNR. Subsequent investigations conducted years later – although far later than they should have been – have confirmed that the contamination has spread offsite onto neighboring residential properties. As shown on Exhibits 3-9, there is widespread contamination that extends offsite an undetermined distance to the north, south, east and west. Vapors emanating from the contaminated soil and groundwater have migrated onto neighboring properties. This situation poses enough of a concern to human health that WDNR is using taxpayer money to install subslab depressurization systems in Class Area homes in an attempt to protect residents from Madison-Kipp's chemicals.

The Wisconsin Department of Justice on September 28, 2012 filed a lawsuit against Madison-Kipp, alleging violations of the Wisconsin State hazardous spill laws for failing to report the discovery of hazardous wastes and the disposal of hazardous wastes, and for failing to investigate and clean up the resulting contamination. The lawsuit specifies that PCE and PCB's from Madison-Kipp have contaminated the soil, soil gas and groundwater onsite and offsite. No other potential source of the contamination has been identified.

Madison-Kipp used PCE and discharged it to the environment for many years. The September 2012 deposition of former Madison-Kipp employee James Lenz provides insight into the use and disposal of PCE at the Madison-Kipp facility. Mr. Lenz worked at the Madison-Kipp Corporation from late June 1980 to June 2011, initially as a Senior Manufacturing Engineer (Lenz Deposition, 2012, pp. 8-9). Between approximately 1988 and 2006, Mr. Lenz served as the Facility Engineer at Madison-Kipp (Lenz Deposition, 2012, p. 11). In approximately 1996, he was also given responsibility for environmental engineering at the facility. Thus, from approximately 1996 to 2006, Mr. Lenz was the plant engineering and environmental manager (Lenz Deposition, 2012, p. 17).

Since Mr. Lenz had been at Madison-Kipp, the facility had two divisions, the Lubricator Division which operated out of the Waubesa end of the building and the Die Casting division which operated out of the Atwood end of the building (Lenz Deposition, 2012, p. 34). Mr. Lenz indicated that both divisions used PCE for cleaning parts at one time or another (Lenz Deposition, 2012, p. 34).

Mr. Lenz summarized Madison-Kipp's past attitude regarding disposal of liquid waste, including PCE:

> Mr. Lenz: "You just throw it wherever the closest place to throw it."
> Q: Throw what?
> A: whatever you want to get rid of.
> Q: Including PCE?
> A: Yes.
> Q: That was the attitude at the time?
> A: Yes.
> Q: Is throw it wherever?
> A: Yes. (Lenz Deposition, 2012, pp. 72-73).

***Madison-Kipp used PCE in vapor degreasers and to clean tools***

The PCE which Mr. Lenz says was "thrown wherever" was used by Madison-Kipp in a vapor degreaser to clean parts in the post-manufacturing process (Lenz Deposition, 2012, p. 37). The vapor degreaser was used at different times by both divisions. Mr. Lenz recalled that, in 1983 or 1984, the Die Casting Division transferred the vapor degreaser to the Lubricator Division. Mr. Lenz indicated (Lenz Deposition, 2012, p. 35) that the vapor degreaser was physically moved from one position to the other. The Lubricator Division used the vapor degreaser from that time until it was sold in 1992 (Lenz Deposition, 2012, pp. 34-36).

Mr. Lenz indicated that the parts to be cleaned in the degreaser were put in wire baskets. The baskets were then picked up with a small hoist and set above the open tank wherein heated PCE vapors would condense on the cold parts and drip off thereby cleaning the parts of any residual oil. The vapor degreaser consisted of an 8-foot tall tank that sat on the floor with dimensions of approximately 6-feet by 4-feet. There was a hood on the top that had a duct and a fan that blew the vapors outside (Lenz Deposition, 2012, p. 38). Mr. Lenz confirmed that PCE vapors from the degreaser were simply vented to the atmosphere (Lenz Deposition, 2012, p. 38).

The vapor degreaser contained 75 to 100 gallons of PCE. When it needed to be refilled, employees filled 5-6 gallon buckets from an above-ground storage tank and hand-carried the buckets back to the degreaser (Lenz Deposition, 2012, pp. 39-41).

In addition to being used in the degreaser, Mr. Lenz indicated that PCE was a common cleaning agent that was used at the plant to clean parts or tools, and sometimes it was used with a brush to simply clean machines. Mr. Lenz indicated that the die cast operators would fill a bucket with a few inches of PCE and use the solvent to clean their machines.

***Madison-Kipp stored PCE on site***

The PCE storage tank for the Die Cast Division was located in the oil shed and the PCE storage tank for the Lubricator Division was located in a small notch on the east side of the building. Each tank had a capacity of approximately 250 gallons (Lenz Deposition, 2012, p. 42). The PCE storage tank was simply filled from a truck with a nozzle similar to how a fuel company delivers fuel oil (Lenz Deposition, 2012, p. 43). PCE was observed to spill onto the ground during refilling of the PCE tank (Lenz Deposition, pp. 44-45). PCE was dispensed from the tank into a bucket via a spigot or valve on the bottom of the tank (Lenz Deposition, 2012, p. 67). PCE was observed to spill onto the ground during dispensing of PCE into buckets. There was at least one occasion in which a leak in the Lubricator Division PCE storage tank caused releases to the environment (Lenz Deposition, 2012, p. 68). Based upon environmental testing data I have reviewed which show high concentrations of PCE at the Site, there were obviously significant losses of PCE to the environment related to operation of the PCE storage tanks.

There were floor drains at Madison-Kipp that would allow spilled liquids to be released from the building. The closest drain to the vapor degreaser when it was used by the Die Cast Division was 50 or 60 feet away (Lenz Deposition, pp. 64-65). This drain is allegedly connected to the sanitary sewer. There was also a floor drain near the PCE storage tank used by the Lubricator Division, which simply discharged onto a grassy area outside the building (Lenz Deposition, 2012, p. 68).

Both PCE storage tanks were situated on concrete pads located outside the plant building, but there was no secondary containment around the tanks that might have contained spills or leaks:

> Q: "So the lubricator division concrete pad had a -- had some sort of drain in it?"
>
> A: It sloped down to a grassy area.
>
> Q: OK, so if anything was spilled on that concrete pad and allowed to roll or to wash off, it would--and it rolled or washed off in the direction of the slope, it would go to the grass?
>
> A: Correct (Lenz Deposition, 2012, p. 69).

WDNR confirmed that there were reported releases of PCE from the storage tanks:

> A. There was an aboveground AST that stored PCE in the northeast portion of the site, and there was a leak that occurred from -- a leak or a spill that occurred from that tank, ran down along the eastern -- north along the eastern side of the building.
>
> Q. Are we talking about a single event, at least according to your understanding? You said a leak or a spill. Are you talking about a single event?
>
> A. I think there's a known single event. I don't know -- I don't think it's reported that it happened repeatedly.
>
> Q. And this was PCE?
>
> A. Yes.
>
> Q. From the aboveground storage tank?
>
> A. Yes.
>
> Q. Which is located approximately where?
>
> A It would be towards the northern portion of the building. To best describe it, if you look at the northern extension of the building, there's an area on the east side of the building where there's an indentation.
>
> Q. Yeah.
>
> A. The tank was in that indentation area.
>
> Q. And for this single event, when did this event occur, this PCE leak or spill from the aboveground storage tank?
>
> A. That I don't recall.
>
> Q. Do you know a decade?
>
> A. '70's or '80's.
>
> Q. How much was spilled or leaked, do you know?
>
> A. No (Schmoller Deposition, 2012, pp. 280-281).

***Madison-Kipp spilled and dumped PCE both inside and outside the building***

Madison-Kipp has a long history of reckless chemical handling and disposal practices. For example, Mr. Lenz stated:

> Mr. Lenz: "Back then there were spills all the time and they weren't worried about."
>
> Q: When you say back then, what do you mean?
>
> A: Early 80's
>
> Q: Okay. So your understanding is that in the early 1980's there were PCE spills all the time, right?
>
> A: That's what I heard from other people.

Mr. Lenz went on to explain that he had come to this understanding from a number of Madison-Kipp employees including George Schler, Wally Largen, and Merv Jelings. The types of spills included PCE sloshing out of a bucket and spilling onto the floor as well as spills when dispensing PCE from the storage tanks. In addition to incidental releases during operation of the PCE storage tanks and the vapor degreasers, Madison-Kipp also purposefully dumped used PCE onto the ground:

> Mr. Lenz: "Back before the parking lot was paved they would just throw buckets of it out the parking lot to get rid of it."
>
> Q: Who - who threw the buckets of PCE out onto the --the area which became the parking lot?
>
> A: People that were cleaning the machine.
>
> Q: What machine?
>
> A: The vapor degreaser.
>
> Q: OK. And now this was spent PCE?
>
> A: Yeah dirty ---
>
> Q: So this is PCE laying, if you will, at the bottom of the degreaser?
>
> A: Yes.
>
> Q: So what you were told was that -- that people at the plant would scoop buckets of spent PCE out of the bottom of the vapor degreaser and pour it outside, right?
>
> A: Correct---
>
> Q: What were you told about where they were poured?
>
> A: Right out the door next to the vapor degreaser. –
>
> Q: Out onto the ground, correct?
>
> A: Correct.
>
> Q: And it's now a parking lot?

A: It's a driveway more than a parking lot there. (Lenz Deposition, 2012, p. 46).

The first PCE contamination discovered was a narrow strip of impacted soil along the building which is exactly where Mr. Lenz indicated that waste PCE was purposefully dumped when employees serviced the vapor degreaser. Further:

Q: Okay. All right. So the general knowledge around the plant was that operators of the vapor degreaser would scoop the spent PCE out of the bottom of the vapor degreaser and walk it outside a door and dump it on the ground outside the building, correct?

A: Correct. –

Q: All right. And this was, according to the general understanding around the plant, this was multiple operators of the vapor degreaser; perhaps 10 or 20, correct?

A: Correct.

Q: All right. And it was general understanding around the plant that this had gone on for some number of years, correct?

A: Correct. (Lenz Deposition, 2012, p. 53).

Mr. Lenz described yet another means by which PCE and other chemicals were intentionally released onto the ground outside the plant. "My understanding was that they just had a tank that they would dump everything into, and they would go out and spread it on the gravel in the parking lot to keep the dust down." This routine dumping apparently included not just PCE but also PCB-bearing hydraulic oil, lubricating oil and other chemicals at the company. In addition to eliminating costs associated with waste disposal, dumping of chemicals onto the ground also allowed Madison-Kipp to accomplish dust control around its facility (Lenz Deposition, 2012, p. 71). Mr. Lenz was asked if there was any reason other than to keep the dust down that these waste oils were spread on the ground and he responded affirmatively that this was just another mechanism by which they were disposing of their wastes.

After around 1988, Madison-Kipp's waste PCE was stored in a tank inside the plant which was periodically pumped out by a gentleman named Max Ashland (Lenz Deposition, 2012, p. 74). Even then, the reason for this change was not due to a concern for the environment or its neighbors. Rather, the reason for the change was that the parking lot had been paved over and there was no longer a convenient place on-site to dump the PCE (Lenz Deposition, 2012, pp. 56-57).

Madison-Kipp owner and Chairman Mr. Reed Coleman also confirmed the practice of dumping waste chemicals onto the ground at the Madison-Kipp facility: "I have heard that many, many years ago when we did not have a blacktop driveway we put some substance on that blacktop driveway to reduce dust, and I do not know what that substance might have been." (Coleman Deposition, 2012, pp. 19-20). He went on to explain:

A. I do know that we used hydraulic oil. I did hear that.

Q. And you know that the hydraulic oil contained PCB's; correct?

A. Yes (Coleman Deposition, 2012, pp. 85-86).

The Madison-Kipp facility is in a low-lying area and during heavy rains, the grounds and even the building would be flooded. Transport of contaminated flood water and sediments from Madison-Kipp was responsible for depositing much of the PCE and PCB's now found in shallow soil in the neighboring residential yards (Lenz Deposition, 2012, p. 97). WDNR agrees with my opinion about contaminant transport by surface water during heavy rains. According to the State project manager:

Q. Have you determined what the transport mechanism was for the PCB found at these homes?

A. Based on what we know of the history of the site, there was a spreading of oils or some other liquid, industrial liquid, for dust control in the northeast portion of the site--- (Schmoller Deposition, 2012, p. 95).

Mr. Schmoller went on to say that the oils included hydraulic fluids which contained PCBs and that the runoff from the Kipp property carried the PCB-bearing oil and PCE to the backyards of the neighboring properties (Schmoller Deposition, 2012, p. 282).

Mr. Schmoller succinctly summarized this interpretation: "If you just look at the distribution of PCE all around the site, it makes sense that -- and you look at it in conjunction with the PCB data and the on-site PAH data, I think the three of those together give a pretty clear picture that whatever fluids were spread for dust suppressant in the northeast or southwest, had those components" (Schmoller Deposition, 2012, p. 283).

***Madison-Kipp vented PCE to the atmosphere***

Surprisingly, the vapor degreaser was not equipped with a condenser (Lenz Deposition, 2012, pp. 77-78). There was no form of vapor recovery or treatment between the basket of parts that were being cleaned and the vent to the atmosphere. Mr. Lenz agrees with my opinion that condensation of PCE vapor from Madison-Kipp's vapor degreaser was responsible for much of the PCE contamination we now see in soil, soil gas, groundwater and vapor\air. Mr. Lenz indicated that as an engineer he felt that during the wintertime the hot PCE vapor would condense and fall on the ground:

A. -- If you look at the elevated soil readings like you see near Monitoring Well 5, and the soil readings we see up in the northeast parking lot, you know, both those are areas where the venting of the degreasing operations occurred, based on our understanding of the site history.

Q. And then the -- the vapor coming out the vent condensed --

A. Yeah.

Q. -- into a liquid and hit the ground, is that basically it?

A. That's the understanding, yes. (Lenz Deposition, 2012, p. 279).

***Madison-Kipp is a source of PAH's on Madison-Kipp and surrounding Class Area properties***

PAH's are present in fuel oil and petroleum combustion products. The location of the former above ground fuel oil storage tank (AST) was identified in the northern most part of the building and noted in Exhibit 2. Madison-Kipp used fuel oil for heating and released PAH's through its smoke stacks and vents. WDNR agrees with my interpretation that Madison-Kipp is the source of PAH's found in the environment on and around the facility: PAHs have been identified in many soil samples (both onsite and offsite) often at levels that exceed the Wisconsin PAH cleanup criteria. Mr. Schmoller indicates that in his opinion both the VOC's and the PAH's are coming from Madison-Kipp (Schmoller Deposition, 2012, p. 100).

***Releases from Madison-Kipp are the source of the PCB's in the environment at the Site and on surrounding Class Area properties***

PCB's are present in some hydraulic oils and Madison–Kipp used hydraulic presses as part of their manufacturing operation. The hydraulic oils were mixed with other liquid wastes and intentionally spread on the gravel parking lots for dust control and for low cost liquid waste disposal. Both the Madison–Kipp environmental manager, Mr. Lenz, and the Company Chairman, Mr. Coleman, indicated under oath that PCB's were used at the site and spread on the gravel parking areas that surrounded the building. The PCBs moved into the neighboring properties after rain events, flood occurrences and wind driven conditions. It is disconcerting to realize that Madison-Kipp has decided to excavate the PCB contamination in soil only on their side of the fence somehow concluding that the neighboring properties were protected by a chain link fence along the property line. This callous disregard for the families who live next door will be seen throughout this report.

**OPINION 2. Madison-Kipp violated applicable standards of conduct in its handling, disposal and releases of hazardous chemicals.**

As acknowledged by Madison-Kipp employees and WDNR, the company dumped and spilled chemicals from the late 1940's until at least 1987. (See Opinion 1) As described in Opinion 2, this disposal behavior violated applicable standards of conduct which, since the 1940's, recognized that dumped and spilled chemicals could contaminate groundwater, and that exposure to PCE could harm humans, and thus

forbade such disposal. What is particularly remarkable here is that, even when strict environmental protection statutes and regulations were enacted in the 1970's and 1980's, Madison-Kipp nonetheless continued to spill and dump these chemicals.

Specifically, applicable standards of conduct violated by Madison-Kipp included:

- containment and capture measures for vapor degreasers, so that spent PCE is re-captured for re-use, and not released to the environment
- containment for PCE (and other chemical) storage tanks, so that chemicals escaping the tanks are not released to the environment
- prohibition of dumping and spilling PCE and other dangerous chemical wastes onto bare ground, for any reason, including to control dust or save money
- dispose of spent PCE and other dangerous chemical wastes in an approved facility

These standards applied with particular force when, as in this case, there were people living in homes immediately next door.

The violations of disposal standards by Madison-Kipp, coupled with its failure to investigate and clean-up these voluminous discharges as documented in Opinion 3, has caused the contamination to spread throughout Madison-Kipp's own property, but also onto the immediately adjacent properties of those in the Class Area and beyond – Madison-Kipp's own neighbors.

### *Environmental Persistence and Toxicity of Chlorinated Solvents Were Documented at Least as Early as the 1950s*

As set forth in this report, the persistence and toxicity of the chemicals involved in this case and the need to use caution in disposing of them, particularly in or near residential areas, has been well-known to industry for many decades. This is especially true when, as is the case here, the residences are in such close proximity to the industrial facility.

Going as far back as the early 1940's VOC's were seen as valuable solvents in support of the war effort. The notion of wasting PCE or TCE was against the national interest and this war experience marked the beginning of a standard of care in the U.S. for handling chlorinated solvents in industry. Therefore, vapor degreasers, in my experience, always had a vapor condenser, in order to save (for re-use) as much PCE as possible. PCE is expensive and with the exception of Madison-Kipp, I have never read of or seen a

facility where 100% of the PCE is vented to the outside without some form of vapor recovery. I have seldom encountered sites, like Madison-Kipp, wherein waste PCE was openly dumped outside on the ground or spread on gravel surfaces, especially not into the 1980s when environmental awareness and environmental regulations were on the rise. The attitude at Madison-Kipp, as noted by Mr. Lenz, was that spilling and dumping of PCE and other chemicals was acceptable and common knowledge in the facility.

The wisdom and need for containment for above ground oil tanks goes back to the 1940's while the RCRA requirements for secondary containment for hazardous chemical storage began in 1976 with the passage of the Act. At Madison-Kipp, the PCE storage ASTs had no secondary containment and worse, one tank area was intentionally sloped to a surface drain that discharged to a garden area along a bike path and (unsurprisingly) is now a serious line source of contamination.

As cataloged in Opinion 1 above, the soil, soil vapor, groundwater and air contamination under and around Madison-Kipp was caused by years of improper chemical handling and inadequate waste management practices. Practices such as spills and leaks from the PCE tanks, spills during transfer of PCE from the storage tanks to the degreaser, dumping spent PCE to the ground, spreading PCE and PCB-bearing oil on the ground for dust control, and venting PCE vapors directly to the atmosphere because the degreaser had no condenser, all contributed to the substantial environmental problem that now plagues Madison-Kipp and the surrounding neighborhood. In fact, even when Madison-Kipp took the positive step of hiring a waste hauler to dispose of its chemical waste, this act was triggered by the paving of their former on-site dumping grounds (thus they were deprived of a convenient place to dump the waste), not by some sense of environmental responsibility.

As I have previously described in Opinion 1 of this report, PCE and other chemicals were dumped and otherwise disposed of at the Madison-Kipp Site from the late 1940s to at least 1987. Because no effort was made for decades to prevent these chemicals from migrating in soil, soil vapor and groundwater, that is precisely what they have done, with the consequence (among many other consequences) that PCE, PCB and PAH contamination has impacted the Class Area.

In the opinion described in detail below, I conclude that Madison-Kipp violated applicable standards of conduct both in its handling and disposal of these chemicals on the Madison-Kipp Site from the 1950s to 1987 and in its failure to adequately address the problem.

As described in Opinion 1 above, Madison-Kipp disposed of PCE (and other chemicals) to bare ground during these years. This disposal practice–along with the cumulative impacts of regular spills, leaks and

atmospheric discharges–represent major sources of PCE contamination throughout the proposed Class Area and beyond.

While scientific knowledge and environmental regulations have evolved in the last few decades, it was widely appreciated at least since the 1950s that dumping such industrial chemicals onto the ground could cause subsurface contamination. It was also widely understood during those years that chlorinated solvents such as PCE and TCE were especially persistent in the environment, and that exposure to these chemicals could cause adverse health effects. In this context, at the time Madison-Kipp was conducting dumping, it could have known and should have known that the practice of dumping industrial chemicals into the ground could cause serious environmental harm (Colten, 1991; Colten and Skinner, 2006)

Madison-Kipp's improper chemical disposal practices in the 1950s, 1960s, 1970s and 1980s were not representative of industry standards. Prior to modern environmental laws such as RCRA and CERCLA, poor waste disposal practices were more common, but the type of dumping conducted by Madison-Kipp was **not** standard practice across the industry during this time. Along with surface water and air pollution, the potential health effects of industrial chemicals in groundwater were well recognized in the 1960s and 1970s.

By 1970, the fact that unregulated industrial disposal of industrial wastes was causing environmental problems was acknowledged by the US Congress. As part of the Resource Recovery Act of 1970, EPA prepared a comprehensive report to Congress on storage and disposal of hazardous waste. The report describes "the imminent and long-term danger to man and his environment from improper disposal of such hazardous wastes."

In 1974, a study commissioned by the newly-formed Environmental Protection Agency (EPA) noted that groundwater can be impacted from spills and surface discharges at industrial sites from such practices as over-pumping during transfer of liquids to or from storage and carriers, by leaks from faulty pipes and valves and by poor control over waste discharges and storm-water runoff (Miller, et al., 1974, Ground Water Contamination in the Northeast States, p. 230). The study went on to say that degradation of ground-water quality over broad areas due to poor housekeeping is well known in sections of the study region. This study is illustrative of the growing awareness that industry's chemicals handling and waste disposal practices can cause groundwater contamination.

RCRA (Resource Conservation and Recovery Act) was enacted by Congress in 1976 and the ensuing regulations went into effect in 1980, thus regulating hazardous waste disposal. CERCLA (Comprehensive

Environmental Response, Compensation and Liability Act, or Superfund) was enacted in 1980. These laws ushered in the modern era of hazardous waste management and groundwater remediation. Even though these federal laws were passed in the 1970s and 1980s, the understanding that groundwater contamination was a serious problem did not suddenly arise in the 1970s and 1980s. Rather, these laws were developed in response to an earlier (and growing) public alarm about this problem. The link between industrial waste disposal and groundwater pollution was widely understood by the 1950s and synthetic organic chemicals like PCE were particularly problematic because of their persistence in the environment.

In the technical literature, the persistence of TCE, (a VOC closely related to PCE), in the environment was noted as early as 1949 by Lyne and McLachlan. The article, published in *The Analyst* a journal published by the Royal Society of Chemistry (London), describes two cases of groundwater contaminated by TCE, one due to a tank release and the second due to a leaking disposal pit.[4] The publication concluded that "contamination by compounds of this nature is likely to be very persistent."

Regarding health effects, our understanding has certainly improved over the years, but the potential negative health effects of chlorinated solvents, like PCE, were also understood during the time period Madison-Kipp was dumping and spilling PCE and other chemicals. For example, recognizing the need to limit workers' exposure, the U.S. Public Health Service published Maximum Allowable Concentrations for workplace exposures to PCE and other chemicals as early as 1943.

Another example of the recognition of the threat to people and the environment from industrial chemicals is the 1974 EPA survey of water quality of the nation's drinking water systems. One goal of this survey was "to determine the concentrations, sources and potential danger of certain organic chemicals in municipal drinking water supplies". This, of course, eventually led to development of drinking water standards or MCLs (maximum contaminant levels) and MCLGs (maximum contaminant level goals). The fact that the federal MCLG for PCE had to be set at a concentration of 0 parts per billion in order to be sufficiently protective of human health speaks to the toxicity of this chemical.

Several guidance documents exist from this era that acknowledge potential environmental problems from land disposal of industrial waste, including a 1956 report from the Manufacturer's Chemists Association and the Handbook of Vapor Degreasing, issued by the American Society for Testing and Materials (ASTM) in 1976.

[4] See: Rivett, Feenstra and Clark, 2006, Lyne and McLachlan (1949): Influence of the First Publication on Groundwater Contamination by Trichloroethene, Environmental Forensics, v. 7, pp. 313-323.

Colten (1991) concluded that, even as early as 1940, the risk associated with surface discharge of chemicals was understood: "...by 1940 knowledge was sufficient to argue against surface discharges of harmful fluids. Legal precedent, though inconsistent, proved there was ample awareness of the physical processes and financial liabilities before 1950 to expect careful disposal of liquid waste to a land surface."

This conclusion is consistent with my experience of the evolution of environmental awareness over my 40 plus-year career as an environmental professional.

***Environmental Managers at Madison-Kipp were not trained for this important job***

Mr. James B. Lenz worked at Madison-Kipp from June of 1980 until June 15, 2011, a period of 31 years. Mr. Lenz graduated in engineering mechanics in May of 1980 and joined Madison-Kipp in June as a project engineer. In 1988 he became the facility engineer. From 1996 to 2006 Mr. Lenz also had the title of Environmental Manager. Mr. Lenz was not a licensed engineer, he never took any environmental courses and he never had any environmental training. He had no groundwater contamination training, no remediation training, no vapor intrusion training, and no training in PCE handling practices. Mr. Lenz was assigned the job on an interim basis and they simply never found a replacement for him.

Mr. Lenz indicated on page 131 of his deposition that in the span of two years (1994-1996) there were four environmental managers at the company. The 1994 letter from WDNR to Madison-Kipp placed responsibilities on Madison-Kipp to characterize and clean up the site but it seems there was no-one on staff with the training or authority to carry out these responsibilities. Mr. Lenz did not know why there was so much turnover, however it took another 18 years before Madison-Kipp began to seriously address WDNR's concerns.

Despite Mr. Lenz's title of Environmental Manager, he was not making the important decisions about the soil and groundwater investigation.

> Q: So even during the 10 years that you were the Environmental Manager and the company was addressing the PCE contamination problem and -- and working with DNR on it, during that 10-year period when you were environmental manager you were not kept in the loop by upper management at the company about disputes with DNR over what needed to be cleaned up and when, right?
>
> A: Correct
>
> Q: You were kept in the dark about that stuff?
>
> A: Yes. (Lenz Deposition, 2012, p. 233).

Mr. Lenz confirmed that upper management, not he as the Environmental Manager, was making the decisions about how to handle the PCE contamination problem (Lenz Deposition, 2012, p. 111).

**OPINION 3. Madison-Kipp violated applicable standards of conduct in its failure to promptly and thoroughly investigate and remediate its contamination and protect people and the environment.**

As set forth above in Opinions 1 and 2, Madison-Kipp discharged toxic chemicals on and around its property from the late 1940's to at least 1987. Under prevailing standards of conduct, including Wisconsin's own statutes and regulations, Madison-Kipp was required to promptly investigate the extent of the contamination its operations had caused, and clean it up. However, as I describe in this Opinion 3, Madison-Kipp not only has failed to investigate the extent of the contamination, but, to the contrary it has spent the years since the chemical discharges (1) ignoring the problem altogether; (2) trying to blame someone else for it; (3) invoking its political ties to support the company's desire to do as little as possible; and (4) portraying the problem as one that is not as serious as it really is. Also, and not surprisingly given its attitude toward competent and timely investigation, Madison-Kipp has yet to determine (let alone implement) a comprehensive remedy for their contamination, which continues to spread. In these ways, documented in this Opinion, Madison-Kipp has violated applicable standards of care. The unfortunate, but predictable, result of this behavior is that the contamination has been allowed to spread unchecked over the decades since discharge, and has infiltrated the properties of Madison-Kipp's neighbors in the immediately adjacent Class Area and beyond.

There are many sources of standards of conduct for environmental investigation and remediation.[5] Perhaps most accessible to Madison-Kipp was Wisconsin's own hazardous substance spill law ("Spill Law"), S. 144. 76 (3) Wisconsin Statutes. Since 1977, this Spill Law required Madison-Kipp to, among other things, determine the extent of the contamination, and clean-up/properly dispose of the contaminants. (See WDNR July 18, 1994 letter to Madison-Kipp).

An important provision of the Spill Law provides as follows:

"Responsibility. A person who possesses or controls a hazardous substance which is discharged or who causes the discharge of a hazardous substance shall take the actions necessary to restore the environment to the extent practicable and minimize the harmful effects from the discharge to the air, lands, or waters of the state."

[5] See, for example, U.S. EPA, 1997, Guidance on the Use of Section 7003 of RCRA; USEPA, 1989, RCRA Facility Investigation Guidance, Interim Final, OSWER Directive 9502.00-6D; and National Contingency Plan: 40 CFR Part 300.

The Wisconsin Administrative Code NR 700 through NR 728 establishes requirements for interim actions, public information, site investigation, design and operation of remedial action systems, and case closure. Wisconsin Administrative Code NR 140 establishes groundwater standards.

In addition to Wisconsin Laws and Codes, there are numerous federal laws, professional societies such as the National Groundwater Association (NGWA) and the American Society for Civil Engineers (ASCE) and national and International Standards Societies such as ASTM International, that provide rules and guidance on environmental site investigation and remediation that I have relied upon. As noted earlier, I am certified by the NGWA, authored the Charter paper in NGWA's peer-reviewed Journal: Groundwater Monitoring and Remediation, and gave numerous contamination site training courses over 10 years on behalf of the NGWA. I am a Fellow of ASCE, a 38 year member, and have published in its peer-reviewed journal. For ASTM, I received their highest honor, the Award of Merit, and have developed numerous national standards in their Groundwater and Vadose Zone Monitoring subcommittee.

Further there are reference books, peer reviewed papers in journals and extensive contamination site experience that I have drawn upon over the past 40 years to make the following criticisms. In short, Madison-Kipp's egregious behavior violates laws, regulations, existing technical guidance, and shows a callous indifference to the health and wellbeing of its neighbors.

The potential for chemicals discharged at Madison-Kipp to volatilize and infiltrate Madison-Kipp's own facility and the homes of its nearby neighbors was well understood since at least the early 1990's. The 1994 DNR letter, discussed below, coincided with a growing national awareness of indoor air impacts of industrial wastes. In the early 1990s as presented by Folks and Arell (2003) in their paper entitled *Vapor Intrusion-EPA's New Regulatory Initiative and Implications for Industry*, the scientific community and the regulatory community were rapidly moving toward a realization of the risk of vapor Intrusion. By 1992 EPA had published its Guidance on "Assessing Potential Indoor Air Impacts for Superfund Sites. By 1993 EPA had published another guidance document entitled: Options for Developing and Evaluating Mitigation Strategies for Indoor Air Impacts at CERCLA Sites. Clearly by 1994 there was sufficient guidance on how to evaluate the potential risks posed by vapor intrusion at VOC-contaminated sites that Madison-Kipp could have followed had they chosen to be responsive to the DNR letter. Instead, Madison Kipp chose to violate existing standards of care. By 1992 I had developed my first ASTM national soil gas sampling standard entitled: Standard Guide for Soil Gas Monitoring in the Vadose Zone (D5314-92; revised in 2006). By 1993 one of my graduate students was already doing research for his MS thesis on subsurface air migration under my direction.

In 1994 (WDNR, July 18, 1994 Letter to Jack Schroeder of Madison-Kipp) WDNR invoked the Wisconsin Spill Law of 1977 and ordered Madison-Kipp to determine the horizontal and vertical extent of contamination and clean-up/properly dispose of the contaminants. WDNR urged Madison-Kipp to act swiftly: "It is important that an investigation begins at your site as soon as possible." Considering that the extent of contamination in the subsurface is still not adequately delineated 18 years later, it is obvious that Madison-Kipp did not act promptly on WDNR's order. WDNR also made the prescient statement that: "The longer contamination is left in the environment, the farther it can spread and the more difficult and costly it becomes to cleanup." By leaving contamination in the ground all these years and focusing on saving money and avoiding controversy, Madison-Kipp has allowed WDNR's prediction to come true, and it is now faced with a more costly and complex cleanup than it would have faced if it had heeded WDNR's mandate. Class Members' exposure to Madison-Kipp's chemicals also could have been discovered many years earlier, which could have led to earlier efforts to mitigate this risk to human health. Instead, residents' exposure to Madison-Kipp's chemicals continued unabated for at least the 18 years of inadequate environmental work at this site (not to mention the many years prior to 1994 that the contamination existed but was not known to WDNR).

Until about one year ago, the opportunity for any meaningful environmental investigation had been marred by Madison-Kipp's inaction and disregard for the potential consequences of its conduct on the health of its neighbors and its own employees. This is the principal reason that, 18 years after WDNR's letter to the company, the Madison-Kipp Site and surrounding residential properties remain severely contaminated. Madison-Kipp's own environmental manager[6] agrees with me that the investigation has been inadequate:

> Q: Mr. Lenz, isn't it true to say that you don't believe Madison-Kipp has adequately addressed the PCE contamination problem?
>
> A: I would say that that's probably true. (Lenz Deposition, 2012, p. 237).

WDNR confirms that Madison-Kipp has not made enough progress in its environmental investigation to have arrived at a comprehensive remedial strategy. As Mr. Schmoller puts it on page 21 of his 2012 deposition: "Well, at this point we have not -- Well, we have not chosen any remedial actions at the site yet, so from their perspective (Madison-Kipp) there aren't any disagreements because there have not been any decisions made."

[6] Mr. Lenz is the individual Madison-Kipp's Chairman of the Board of Directors, Reed Coleman, identified as the one person he trusted to take adequate care of this problem on behalf of Madison-Kipp (Coleman Deposition, 2012, p. 63).

Madison-Kipp's failure to properly investigate is exemplified in the chronology and payment history of the vapor mitigation systems for nearby residents in the last year or so. Faced with the certainty that Madison-Kipp is the source of the chemical vapors threatening neighbors in soil vapor, subslab vapor and indoor air, the company still acted so slowly in mitigating this problem that the State stepped in to complete the task[7]:

> Q Okay. Why is that? Why isn't Kipp paying for that?
>
> A. It was a decision that was made back early this -- early in December, January, December 2011, January 2012. We were concerned about the pace at which things were getting done, and so we said -- we made an internal decision to just go ahead and start doing sampling and mitigation work ourselves to pick up the pace of the rate that it was getting done (Schmoller Deposition, 2012, p. 91).

Even Mr. Coleman agrees that Madison-Kipp did not respond promptly to its environmental problems (Coleman Deposition, 2012, p. 30).

Towards the end of 2011, there was growing frustration at WDNR at the pace at which investigative work was being done, and in particular, WDNR felt a sense of urgency for Madison-Kipp to conduct vapor sampling in subslabs of Class Members' homes.

> "We had indications that we had off-site problems, and, you know, we are dealing with PCE, a carcinogen, and all that sort of thing. Things weren't getting done…So things were getting drawn out and drawn out and drawn out. So I just said, 'this is crazy.' We have got to make a decision. We need to get these samples collected. They are not getting collected. That's when I had made a strong pitch for screw it, let's just us, the agency, go out and take these samples so we can get it done and we will cost recover later." (Schmoller Deposition, 2012, pp. 173-174)

Mr. Schmoller went on to say that there was a lot of internal resistance to his proposal for WDNR to conduct the vapor sampling that Madison-Kipp had neglected to do. Mr. Schmoller expressed further frustration with Madison-Kipp's lack of responsiveness. He indicated that he would have meetings with Madison-Kipp in which there would be no immediate response. He indicated that tasks dragged on for months beyond the date requested by WDNR (Schmoller Deposition, 2012, pp. 176).

In November 2011, Mr. Schmoller's frustration reached an apex and he asked to be reassigned. As he put it, WDNR should "Find somebody who's more than happy to let somebody else control the site. You can assign it to somebody who would be more than happy to let it dog along. If that's what administration wants, fine." (Schmoller Deposition, 2012, pp. 180)

[7] Madison-Kipp paid for vapor mitigation systems for 146, 150, 154, 162 and 166 South Marquette Street but all subsequent mitigation systems were installed using WDNR funds.

***Madison-Kipp's attempts to curtail regulation and avoid public knowledge of its environmental problems***

Even while it delayed action on an adequate environmental investigation, Madison-Kipp also sought to minimize publicity and use political connections to avoid its obligations. As Mr. Lenz stated: "The company was always trying to be hush hush about the environmental situation because of the scrutiny that we got from the neighbors and the media." Mr. Lenz went on to acknowledge that it was just common knowledge not to talk about the environmental problems at Madison-Kipp (Lenz Deposition, 2012, p. 163). The WDNR project manager, Mr. Schmoller, indicated that at some point he was aware that Madison-Kipp had gone to the Governor's office complaining about what the State was requiring Madison-Kipp to do at the site (Schmoller Deposition, 2012, pp. 163-164). In his 30 years with WDNR Mr. Schmoller did not recall any other case in which a regulated company went to the Governor's office complaining about decisions that were being made relative to an investigation and cleanup of a site (Schmoller Deposition, 2012, p. 169).

According to a memo from Michael, Best & Freidrich, LLP, Madison-Kipp's attorney, Madison-Kipp solicited the state to file a lawsuit against it because "MKC would prefer to spend its resources defending allegations against the State of Wisconsin and restoring the environment than paying out-of-state plaintiffs' counsel given that the federal statute provides for the plaintiffs' attempted recovery of their fees and costs."

According to WDNR's project manager, Mr. Schmoller, this was an unusual request. He was asked whether he had ever been involved in a situation where a company that was being regulated by DNR asked DNR or the State to sue it to block citizens from suing the company themselves. Mr. Schmoller indicated that he had never been involved or even heard of anything like that (Schmoller Deposition, 2012, p. 151). In September of 2012, the State of Wisconsin eventually did sue Madison-Kipp alleging (among other things) that Madison-Kipp failed to notify the state of a chemical release and failed to take actions necessary to restore the environment or to minimize the harmful effects to lands or waters of the state caused by the discharge of PCE and PCBs.

***Madison-Kipp's goal: spend as little money as possible***

In my experience, it is not unusual for a responsible party in an environmental cleanup to seek cost efficiency. However, Madison-Kipp sought to minimize costs by denying responsibility for its own actions and failing to acknowledge the consequences of its inaction on its neighbors. On page 190 of his deposition, Mr. Lenz is asked:

Q: Did you ever hear that one of the company's goals was to spend as little as money as possible?

A: Yes - - -

Q: OK, who did you hear that from please?

A: Tom Caldwell. I probably heard it from several people.

Q: Caldwell told you that?

A: Yes.

Q: Alright, and he told you that when he was the President of the company?

A: Yes.

***Madison-Kipp delayed the cleanup by denying it was the source of the contamination***

As previously referenced in this report, Madison-Kipp was required to conduct a timely, proper and thorough investigation of the contamination. Madison-Kipp failed to meet these requirements and instead delayed the investigation and failed to conduct a proper and thorough investigation. An example of this failure is Madison-Kipp's denial of its responsibility for the profound subsurface impairment, even in the face of growing evidence to the contrary. For example, according to Mr. Lenz, there were discussions at Madison-Kipp about blaming other companies for the PCE contamination:

Q: Sure. Were there discussions at the company, Madison-Kipp, where people at the company were blaming some other company or somebody else's property, at least initially, for the PCE contamination saying it came from someplace else?

A: Yes. I remember conversations about that because the way the water flow direction that I was told about, it was coming from the Kupfer Iron Works direction.

Q: Who told you that?

A: I think I heard that from Jack Schroeder.

Q: Okay. The environmental manager, right?

A: Yeah. (Lenz Deposition, 2012, pp. 120-121).

This strategy of avoidance was communicated to Madison-Kipp's consultants as early as 1994. Mr. Lenz described communicating to Dames & Moore (an early environmental consultant at this site) that Madison-Kipp's goal was to conduct just enough investigation to support the theory to WDNR that the source of the contamination was coming from offsite so that its cost for investigation would be held to a minimum. (Lenz Deposition, 2012, p. 128). It is sadly notable that Madison-Kipp expressed no concern whatsoever for the well-being of its employees or of its neighbors who, unknowingly, were being exposed to its chemicals on a daily basis. Nor did Madison-Kipp express any concern for protection of the environment or of the growing possibility that its chemicals were impairing groundwater resources of the

State. Its only concern was to avoid a proper investigation by blaming someone else and minimizing its costs. Mr. Lenz was troubled by this strategy (but apparently not troubled enough to do anything to correct it):

> Q: Do you think that what [Madison-Kipp employee] Schroeder is saying here to the president of the company and another member of upper management, vice president of the company, is acceptable?
>
> A: --- Not if I'm signing my name to it, no. ---
>
> Q: OK why wouldn't you? That's not right is it? That's not right to -- to be doing that is it?
>
> A: I agree it's not right. (Lenz Deposition, 2012, p. 134).

Unlike Mr. Lenz who at least had a tinge misgiving about Madison-Kipp's strategy, Mr. Coleman to this day defends the strategy: "Yes, I think that was the right thing to do." (Coleman Deposition, 2012, p. 124).

Another of Madison-Kipp's cost-containment strategies was to deny that any of the contamination extended offsite:

> Q: Do you recall any discussion at the company about how the - - the company['s] hoping the environmental problem did not go offsite and affect the neighbors?
>
> A: Yes.
>
> ...
>
> Q: Was that a concern expressed? That this is going to be a lot more expensive to deal with if the contamination has gone on to neighbors properties?
>
> A: Yes it was a concern.
>
> Q: Sure. Expressed by whom?
>
> A: [Madison-Kipp, President]Tom Caldwell. (Lenz Deposition, 2012, pp. 225-226).

It's difficult to tell if its denial of off-site migration of the contamination was wishful thinking or knowing misinformation. Regardless, it has since proven to be completely wrong.

***Madison-Kipp delayed the investigation and the cleanup by not being responsive to the 1994 order***

As noted above, WDNR ordered Madison-Kipp to determine the horizontal and vertical extent of contamination and clean-up or properly dispose of the contaminants in the July 18, 1994 letter from Marilyn Jahnke, Emergency & Remedial Response Program to Mr. Jack Schoeder of Madison-Kipp. Just 3 months earlier, on April 7, 1994 Mr. Jack Schroeder of Madison-Kipp wrote a memo to fellow

employee Lyle Crouse and copied President Tom Caldwell, stating he had received a call from Mike Halsted from WDNR that the Madison Brass Works site investigation showed that the PCE contamination came from offsite (i.e., from Madison-Kipp). Schroeder told Halsted that Madison-Kipp does not currently use PCE. Schroeder said he told Halsted that there was past history at the Kupfer Iron Works facility of soil contamination and underground tank removal. However, as noted previously by Mr. Lenz, the use of PCE was well known around Madison-Kipp as was the intentional dumping and spills. By not revealing this information that was common knowledge among site workers, Madison-Kipp was being evasive and trying to place the blame for contamination on other facilities, from the very beginning of its interactions with state regulators.

With its 1994 letter to Madison-Kipp, WDNR expressed a sense of urgency when it requested that Madison-Kipp begin environmental activities at the site as soon as possible. Five years later, the work had not been completed and WDNR expressed its displeasure:

> "It has come to my attention that investigative efforts at the above site have not progressed as proposed. To date, the vertical and horizontal degree and extent of groundwater contamination has not been determined at the site. In addition, quarterly sampling of site monitoring wells has not been conducted as required." (WDNR, June 30, 1999 letter from Lawrence Lester to Bud Hauser of Madison-Kipp).

The delays persisted for years. On this issue, WDNR's Schmoller testified:

> Q Isn't the State in 2006 telling Madison-Kipp essentially the same thing that it's been telling Madison-Kipp since 1994?
>
> A: Yeah. (Schmoller Deposition, 2012, p. 294).
>
> Q That's the same spill law in paragraph 22 that was in the 1994 responsible party letter, right?
>
> A Correct.
>
> Q And it's the same spill law that's cited in the Department's 1999 letter to Madison-Kipp, which is Schmoller 32 in this deposition, right?
>
> A Correct.
>
> Q And it's the same spill law that is cited in Schmoller No. 33, the bottom of page 1 of Schmoller No. 33, which is the Department's letter to Madison-Kipp in September of 2006, correct?
>
> A Correct.

WDNR's project manager, Mr. Schmoller, agrees with me that Madison-Kipp's efforts between 1994 and the current day have not been sufficient to define the full extent of the contamination, and over this long span of time there also hasn't been an adequate cleanup of the contamination (Schmoller Deposition,

2012, p. 296). Mr. Schmoller also agrees with me that much of the work being conducted this year could and should have been completed years ago (Schmoller Deposition, 2012, p. 299).

> Q.--- what the State told Madison-Kipp to determine, which is the nature and extent, the horizontal and vertical extent of groundwater contamination, drilling those wells that are going to be drilled in 2012 would have been a very appropriate thing to do.
>
> A. Yes. Those -- To meet the requirements of the spills law, those wells could have been installed earlier.
>
> Q. They're being drilled 18 years after the State told Madison-Kipp to determine the horizontal and vertical extent of groundwater contamination, right?
>
> A. Yes. (Schmoller Deposition, 2012, p. 300).

In February of 2005 a soil sample was collected near the Madison-Kipp property line, just five feet or so from a neighbor's residential yard. The sample contained 51,800 parts per billion of PCE. Such a high value in shallow soil raises a strong concern for the potential of vapor migration. According to WDNR project manager, Mr. Schmoller, if those concentrations had been identified today, his agency would be out in the field in a couple of months looking at subslab vapor in the nearby residences. (Schmoller Deposition, 2012, p. 208). However, at this site, it took Madison-Kipp years to get around to testing subslab vapor in neighbor's homes, and when the sampling was finally conducted, PCE was detected in vapor under most of the homes and even inside some of the homes. Strikingly, Madison-Kipp's current environmental consultant, ARCADIS, rejects that soil contamination is contributing to the PCE vapors on neighboring properties. (Trask Deposition, 2012, p. 174). This conclusion lacks credibility and is indicative of the non-scientific analysis being performed at this site.

The ARCADIS project manager, Ms. Trask, also agrees with me that WDNR's 1994 directive to Madison-Kipp to determine the horizontal and vertical extent of contamination and cleanup/properly dispose of the contaminants has not been satisfied (Trask Deposition, 2012, p. 140). For example, only within the last year, an SVE system was installed in the northeast portion of the site (ARCADIS, 2012, SVE Pilot Test Summary Report); a PCB investigation for soil was conducted on and off site (ARCADIS, 2012, Work Plan for PCB Investigation); new deep bedrock groundwater monitoring wells were installed (ARCADIS, 2012, Bedrock Characterization Work Plan); off-site soil vapor sampling was conducted; and soil sampling was conducted under the Madison-Kipp building (ARCADIS, 2012, Site Investigation Work Plan). All of the above activities could have been conducted in the 1990s. In a case like this with PCE in groundwater and soil vapor, as Ms. Trask concurred, it is important to promptly undertake an investigation and cleanup (Trask Deposition, 2012, p. 142). It is ironic that, in 2012, Madison-Kipp's consultant is mimicking WDNR's 1994 admonition to conduct the environmental work promptly. Even

though Ms. Trask agreed that the work should have been conducted sooner rather than later, the 18 year delay did not concern her enough to ask anyone:

> Q. Did you ever ask anybody why it's taken more than 18 years to look under the building?
>
> A. No. (Trask Deposition, 2012, p. 143)

Madison-Kipp's long-term lack of response has allowed the contamination to spread, has dramatically increased the complexity of the cleanup and has subjected the families in the Class Area to decades of exposure and property damage.

***Madison-Kipp still denies the magnitude of its environmental problems***

Part of the delay was due to repeated and unsubstantiated claims from Madison-Kipp that the contamination was not as bad as it turned out to be. In combination with the strategy of blaming others for the contamination, Madison-Kipp was able to avoid the expense of a thorough investigation and cleanup for the decades since the chemicals were initially dumped, spilled, etc. The denial persists to this day: in his 2012 deposition, Mr. Coleman stated: "I don't believe it's a serious problem." (Coleman Deposition, 2012, p. 37). Even Mr. Coleman's own staff can't bring themselves to back their boss's incredible claim that the environmental impairment at this site is not a serious problem:

> Q: Is there ever a time on up through today where you would have described the amount of PCE contamination in the soil as minor?
>
> A: I don't -- No. (Lenz Deposition, 2012, p. 170).

Mr. Coleman can't be dissuaded: Q. So you believe, even given what you know in 2012, that the PCE contamination in the soil on your company's property and the groundwater on your company's property and in the vapor underneath your neighbors' homes is a rather normal and rather widespread occurrence. A. Yes. (Coleman Deposition, 2012, p. 140).

Another example of Madison-Kipp's strategy to understate the magnitude of this problem is its assertion that only four or five homes directly adjacent to the Madison-Kipp facility would require vapor probes in the yards. WDNR did not agree with this unsubstantiated assertion (Schmoller Deposition, 2012, p. 177). Subsequent sampling has detected Madison-Kipp's contamination in soil vapor on at least 49 residential properties (Exhibit 3). As described above, WDNR has taken over the job of installing subslab depressurization systems in homes because of frustration with the pace of Madison-Kipp's work. To this day, Madison-Kipp's Chairman of the Board of Directors denies any obligation to protect the neighbors from Madison-Kipp's carcinogenic chemicals: "So from my point of view, we have erred on the side of

providing [home depressurization systems] and not on the side of resisting." (Coleman Deposition, 2012, p. 41).

In a 2009 report (Schmoller 19 exhibit) RSV (another of Madison-Kipp's environmental consultants) recommended no further sampling or proper abandonment of the off-site soil wells, "due to low VOC detection." This "no further testing necessary" position has been taken by Madison-Kipp and its consultants repeatedly since 1994, even though it has never been warranted. For example, notwithstanding RSV's 2009 report conclusion, we now know that PCE in off-site soil vapor is one of the most pressing problems at this site. WDNR recognized the unsupportable nature of, and thus rejected, RSV's recommendation (Schmoller Deposition, 2012, p. 190). In Schmoller Exhibit 25, Schmoller had noted a request for a perimeter soil gas survey to be made of the Madison-Kipp facility that was never done because it was denied by the company (Schmoller Deposition, 2012, p. 205). The potential danger to neighbors from exposure to Madison-Kipp's toxic chemicals would have been understood earlier if Madison-Kipp had heeded WDNR's request.

Decades of Madison-Kipp's cavalier attitude toward management of toxic chemicals has led to massive releases to the environment and an exceptionally slow response to this problem. The corporate attitude that gave rise to this unfortunate (and largely avoidable) situation is perhaps exemplified by Madison-Kipp's CEO Mr. Coleman who (even in 2012) expressed no regrets about any aspect of his company's behavior regarding the PCE contamination problem, either how the PCE got out of the plant and into the environment, or how his company dealt with the problem once the problem became known (Coleman Deposition, 2012, p. 152).

***Madison-Kipp has used its environmental consultants as advocates, not fact-finders***

In 2011, ARCADIS was retained by Madison-Kipp's attorneys, Michael Best & Friedrich (MB&F), to serve in a confidential consulting relationship, to perform confidential services and to assist the law firm in rendering legal advice to Madison-Kipp (MB&F February 1, 2012, Letter from David Crass to Jennine Trask of ARCADIS). According to this agreement, ARCADIS' work is to be performed under the direction of the law firm, not Madison-Kipp's environmental manager or anyone without a direct interest in Madison-Kipp's success in this lawsuit.

Madison-Kipp's use of environmental consultants as advocates did not begin with ARCADIS. According to Mr. Schmoller of WDNR, there were numerous occasions in which the previous consultant, Mr. Robert Nauta, recommended that no further work should be done even though WDNR believed strongly to the contrary (Schmoller Deposition, 2012, pp. 209-210).

The recent sequence of events relating to discovery of PAHs in off-site soil is a good example of ARCADIS engaging in advocacy at the expense of good science. PAHs are polycyclic aromatic hydrocarbon compounds. PAHs are a family of complex hydrocarbon molecules found in crude oil and other petroleum products. They are also formed during combustion of petroleum and other organic substances. Some PAHs are highly carcinogenic. In the summer of 2012, soil sampling on the Madison-Kipp site and in nearby residential yards found PAHs, some of which are in excess of Wisconsin's non-industrial direct contact RCL (Residual Contaminant Level). In September of 2012, ARCADIS' Ms. Trask wrote a letter to the State of Wisconsin on behalf of Madison-Kipp asserting that there was insufficient evidence that PAHs originated from the Madison-Kipp site and that, therefore, they should not be a "driver" for off-site remediation. Ms. Trask noted that its subcontractor observed burn pits and backyard grills in nearly every property that borders Madison-Kipp, thus implying that backyard barbeques may be to blame for contaminating the neighbors yards with PAH's, not the 100-year old industrial facility situated mere feet away from the residential lots that had a long history of releasing toxic chemicals to the environment and a long history of denying the consequences of this legacy. It may be true that more data would clarify the nature and extent of PAH contamination in the neighbors' soil, but ARCADIS' first response to these findings is to question Madison-Kipp's responsibility and to play down the potential severity of the problem. This is advocacy and not technical inquiry.

The data currently available demonstrate that, there were more exceedences of state standards for PAHs in the top two feet of soil from neighbors' yards than for any other chemicals: more exceedences than PCBs and more exceedences than VOCs, including PCE. As described by Ms. Trask:

> Q. You didn't want PAHs to be the compound that determines how much off-site remediation has to be implemented, is that true?
>
> A. Yes.
>
> Q. Okay. And you are talking there, aren't you, about residential results, right?
>
> A. Yes.
>
> Q. And you are talking there about results on my clients' property, right?
>
> A. Yes.
>
> Q. And you knew if you were successful in getting the state to agree to this argument that PAHs not be the driver, that less residential soil would be remediated, true?
>
> THE WITNESS: Yes.
>
> Q. And you were doing that on behalf of Madison-Kipp, true?
>
> A. Yes. (Trask Deposition, 2012, p. 87).

Ms. Trask, is by her own admission, "not a PAH expert" (Trask Deposition, 2012, p. 96). She acknowledged in her deposition that she did not know that there are analytical methods that can be used for differentiating PAHs from different sources. This admission is all the more striking because it highlights that the assertions in Ms. Trask's September 11, 2012 letter are not based on a sound knowledge of the environmental fate and transport of PAHs. In my opinion, the basis of ARCADIS' assertions about whether or not Madison-Kipp may have caused the PAH impacts in the neighbors' yards is simply a desire to avoid an even costlier cleanup.

When asked if she would have been interested in knowing about these analytical methods that can be used to differentiate PAH sources before arguing that the PAHs should be left in place and should not be a driver of cleanup, Ms. Trask agreed:

> A. That there's a method to analyze?
> Q. Correct.
> A. Would I have wanted to know that?
> Q. Correct.
> A. Yes. (Trask Deposition, 2012, p. 97).

According to Ms. Trask, an attorney was always present during ARCADIS' meetings with WDNR (Trask Deposition, 2012, p. 129). While it is permissible for attorneys to be present at technical meetings with environmental regulators, in my experience, it is unusual for the regulated company's attorney to attend every meeting.

***ARCADIS neglected to inquire about Madison-Kipp's historical chemical usage***

A site investigation generally includes an historical analysis to understand how chemicals were used at the site and how and where they may have been released. This type of inquiry is done both for efficiency and for completeness (i.e. to minimize the possibility of missing contamination at a certain place because the consultant does not know to look there). Madison-Kipp's Mr. Lenz agrees with this opinion. He indicated that it was important for the company to investigate and to learn all of the different places where PCE had been spread or spilled or dumped. To date, however, ARCADIS has not interviewed Mr. Lenz about the sources of the contamination, nor has ARCADIS ever reviewed or asked for operational records from Madison-Kipp which could show when materials containing PCE, PCBs, or PAHs were purchased, how much was purchased and how the chemicals were used at the facility (Trask Deposition, 2012, pp. 99, 101). Neither has WDNR interviewed any current or past employees in an effort to determine where PCE might have been spilled or leaked within the plant (Lenz Deposition, 2012, pp. 271, 274). As such,

ARCADIS does not know, and even WDNR does not know, how much PCE was disposed of, or where, by Madison-Kipp (Trask Deposition, 2012, pp. 99, 101).

One month before the WDNR July 1994 letter to Madison-Kipp, the National Research Council published a book entitled: Alternatives to Ground Water Cleanup. Prior to publication, the volume was reviewed by the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine. A key chapter in the book is entitled Characterizing Sites for Ground Water Cleanup with a subchapter entitled Plume versus Source which states:

"Conceptually, the contaminated ground water environment consists of two distinct parts, as explained in Chapter 2: (1) the plume of dissolved contaminants and (2) contaminant source areas. Contaminant source areas include not only typical near-surface sources such as leaking drums, process wastes, and sludges, but also deep subsurface sources such as residual nonaqueous-phase liquids (NAPLs), pools of NAPLs, and metals that have precipitated in mineral phases having low solubility. The prospects for ground water cleanup are much different for the plume of dissolved contaminants than they are for the source areas. Based on this observation, it is clear that site characterization studies should be designed to define early the parts of the site that can be considered source areas and the parts that can be considered as the dissolved plume, because the potential remedial options are significantly different for the two parts."

At Madison-Kipp, source areas still have not been defined; the dissolved plumes in the shallow and deep groundwater have not been defined; and the potential for DNAPL cannot be ruled out; since the sources have not been identified. Madison-Kipp's haphazard approach violates every standard with which I am familiar regarding site characterization.

In my capacity as a member of the Interagency DNAPL consortium, I am aware that determining the mass of VOCs/PCE in-situ is extremely difficult and therefore that it is very important to try to determine the usage of PCE by evaluating purchasing records or waste manifests or by other means, including personal inquiries. Madison–Kipp did not attempt to use any of these approaches and have not provided any records of VOC/PCE purchases.

Ms. Trask went so far as to assert that it is not important to know how and when PCE was disposed of at a site when trying to reach conclusions as to the nature and extent of the problem and how to remediate it (Trask Deposition, 2012, pp. 99, 105-106). I strongly disagree with this perspective and highly doubt that this opinion is widely shared by other ARCADIS professionals. The ASTM standard for Phase I Environmental Site Assessments (ASTM E1527) clearly calls for a records review and interviews with

past or current occupants of a facility in order to identify recognized environmental conditions. This type of historical inquiry is a standard part of an environmental investigation.

***Madison-Kipp did not investigate under degreaser locations***

Most of the PCE consumed at this site was used in the vapor degreaser which was positioned in at least two different locations during its operation at the site. It is common for there to be spills and leaks from vapor degreasers: parts are cycled through the degreaser, PCE needs to be added periodically, and the PCE reservoir needs to be cleaned out on occasion. For these reasons, it is unacceptable that Madison-Kipp has not investigated soil and soil vapor under and around the degreaser locations for PCE contamination.

***Madison-Kipp did not investigate under central trench or laterals***

There is a trench or pipeline underneath the floor of the Madison-Kipp building that carried either cooling fluids or cutting fluids. The trench or pipeline runs north-to-south across the central portion of the building. The pipeline was connected to a network of laterals leading from Madison-Kipp's various machines. It should have been obvious to Madison-Kipp and its consultants that this pipeline and the laterals should have been investigated for chemical contamination. This is because leaks may have been difficult to detect (thus could have persisted undetected for a long period of time) and leaks from the pipeline would be a potential source for contamination underneath the building. WDNR agrees that the pipeline should be investigated (Schmoller Deposition, 2012, pp. 284-285).

***Madison-Kipp did not investigate sanitary or storm sewer pathways***

Manmade structures such as buried utility lines and sewers can serve as preferential pathways for contaminant migration in the subsurface. ARCADIS believes that preferential pathways in sewers or utility trenches are not contributing to the offsite migration of contaminated vapors.[8] However, as Mr. Schmoller of WDNR points out, the potential for migration along preferential pathways has not been investigated and he did not even know where the sewer lines run at the site (Schmoller Deposition, 2012, p. 69). It is certainly premature for ARCADIS to conclude that migration along preferential pathways is not a problem prior to conducting an inquiry into this matter. ARCADIS and Madison-Kipp are mistaking a lack of information (because they have not sought to collect it) for a lack of contamination. This is a serious flaw in their reasoning and interpretation of environmental conditions.

[8] Q. Okay. So do you know whether sewers, facilitated flow through sewers or utility trenches are contributing to the vapors detected under the homes in the area? A. To my knowledge, no. (Trask Deposition, 2012, p. 174).

***Madison-Kipp contractors only recently began to investigate under the building***

One of Madison-Kipp's most egregious omissions since receiving the July, 1994 WDNR letter is its failure to comprehensively test soil and soil vapor under its own building. This is where the PCE degreaser was located. This is where PCB-bearing oil was likely used. This is where the trench or pipeline carried liquid wastes. Only now, in 2012, is this obvious component of the environmental site investigation being performed. If for no other reason, I would have expected Madison-Kipp to carry out such an investigation out of concern about potential exposure of its own employees to toxic chemicals under the building.

**OPINION 4. The soil, soil gas, groundwater and vapor/air contamination at and released from this Site and into the Class Area constitute an imminent and substantial endangerment to human health and the environment within the meaning of the Resource Conservation and Recovery Act (RCRA). The imminent and substantial endangerment will persist indefinitely unless effective remedial actions are implemented.**

For purposes of my opinion, I have consulted guidance documents, including those prepared by the U.S. EPA. U.S. EPA "Guidance on the Use of Section 7003 of RCRA" states the following with regard to the definitions of imminent and substantial endangerment:[9]

> "An 'endangerment' is an actual, threatened, or potential harm to health or the environment… As underscored by the words 'may present' in the endangerment standard of Section 7003, neither certainty nor proof of actual harm is required, only a risk of harm… Moreover, neither a release nor threatened release, as those terms are used in CERCLA, is required… No proof of off-site migration is required if there is proof that the wastes, in place, may present an imminent and substantial endangerment."
>
> "An endangerment is 'imminent' if the present conditions indicate that there may be a future risk to health or the environment… even though the harm may not be realized for years… It is not necessary for the endangerment to be immediate… or tantamount to an emergency."
>
> "Because conditions vary dramatically from site to site, there is no comprehensive list of factors that EPA should consider when determining whether conditions may present an imminent and substantial endangerment… Some of the factors that the Regions may consider appropriate are: (1) the levels of contaminants in various media; (2) the existence of a connection between the solid or hazardous waste and air, soil, ground water, or surface water…"

There can be no dispute that the industrial chemicals used and released at Madison-Kipp such as PCE, PCBs, and PAHs are hazardous wastes, within the meaning of RCRA. Madison-Kipp engaged in the handling, storage, transportation and disposal of this hazardous waste.

[9] U.S. EPA, October 20, 1997, Memorandum, Subject: Transmittal of Guidance on the Use of Section 7003 of RCRA.

The contaminants PCE, PCBs and PAHs - - emanating from Madison-Kipp's property - - have been found throughout the Class Area (and beyond) in soil, soil gas, subslab vapor and, for some homes, in the indoor air. PCE from Madison-Kipp likewise contaminates the shallow groundwater just 20 or so feet below these homes, and the deeper groundwater aquifer below that. In short, toxic chemicals from Madison-Kipp contaminate, or threaten to contaminate, virtually every dimension of the surrounding neighborhood, including the Class Area.

Of the many scientifically significant facts here, the most significant are these:

(1) Throughout the relevant time period, Madison-Kipp's neighbors in the Class Area lived immediately adjacent to the facility – literally just feet away.

(2) Each of the relevant chemicals is either a known or potential carcinogen, and thus poses a potentially serious threat to humans, especially children. The Expert Report of Dr. David Ozonoff, on which I explicitly rely here, articulates very clearly that, for example, PCE is potentially dangerous to humans in any concentration.

(3) Each chemical has long ago reached the neighborhood properties, often via multiple means. In environmental terms, this means that the "pathway" is complete, *i.e.*, the chemicals have found a way - - via groundwater, gas, wind, water run-off, etc. - - to travel from Madison-Kipp to neighborhood properties. Also, since Madison-Kipp has thus far failed to foreclose any of these pathways, the large volume of toxic chemicals today contaminating Madison-Kipp's property continue to travel one or more of these pathways to the Class Area and beyond.

(4) The concentrations of chemicals remaining on Madison-Kipp's property, which continue to travel via already well-travelled pathways to the Class Area and beyond, are very high, in some cases dangerously so (in soil, soil gas and groundwater).

These scientific facts, discussed more fully below and throughout this report, show that the abundant toxic chemical contaminants in both the Class Area (and beyond), and on Madison-Kipp's own property, easily satisfy the standard articulated in RCRA, *i.e.*, "may present an imminent and substantial endangerment to health or the environment".

***Years of chemical releases at Madison-Kipp have caused the imminent and substantial endangerment***

For many years prior to 1987, Madison-Kipp discharged large volumes of toxic chemicals to the ground and air on its own property. These releases caused severe contamination on the Madison-Kipp site but the chemicals were also allowed to migrate in the environment to cause high levels of off-site contamination of the soil, soil vapor, and groundwater in the Class Area with VOCs, including PCE, as well as PCBs and PAHs (as described in more detail in Opinions 1-3 of this report). Residents of the Class Area and workers at Madison-Kipp have been exposed to these chemicals for many years and the exposure continues to this day. This constitutes an imminent and substantial endangerment to human health. In addition, the groundwater under and around Madison-Kipp has been degraded to the point that it is unusable for beneficial uses (and will likely remain that way for decades into the future). Well No. 8, a public water supply of the Madison Water Utility is approximately 1,000 feet south of Madison-Kipp and low levels of a breakdown product of PCE has been detected in this well (Wisconsin State Journal, April 23, 2012, "Neighbors worry as toxic plume from Madison-Kipp Corp. nears well," by Ron Seely). According to Joseph Grande of the Madison Water Utility, pump tests showed a hydrologic connection between Well No. 8 and the Madison-Kipp monitoring wells. This threat to the quality of the public water supply constitutes an imminent and substantial endangerment to the environment. The imminent and substantial endangerment is the direct result of the conduct of Madison-Kipp regarding chemical and hazardous waste handling and disposal, as well as its subsequent failure to promptly and adequately address its environmental problems.

Soil and groundwater data collected thus far confirms the release of dense non-aqueous phase liquid (DNAPL) into the groundwater; confirms high levels of dissolved VOC contamination in groundwater plumes extending throughout the Class Area and beyond; confirms the presence of contaminated vapor under the homes in the Class Area; and confirms the presence of PCE, PCBs and PAHs in shallow soil in the residential yards of the Class Area. The operational history of Madison-Kipp and the hydrogeology of the site show that this problem has existed in the Class Area, and has persisted largely unabated, for decades.

***Residents in the class area are exposed to Madison-Kipp's toxic chemicals***

Madison-Kipp's PCBs have been found in the soil from the yards of 23 of the 32 homes tested in the Class Area and its PAHs have been found in 32 of the 34 yards tested (see Table 1). Madison-Kipp's PCE has been found in soil vapor or subslab vapor for nearly every home tested in the Class Area. Some of the residential properties also had PCE detected in indoor air. This toxic chemical has migrated from

Madison-Kipp's soil and groundwater, through the vadose zone and into the homes. Even where the levels are below the WDNR action level, the presence of PCE shows a continuing invasion, and the pervasive contamination on Madison-Kipp's property just feet away from these homes constitutes an ongoing threat. The fact that chemicals are detected in any amount on the residential properties, coupled with the undisputed presence of contaminated soil in the yards and groundwater under the homes, shows that all of these Class Area properties have been impacted, and remain threatened, by chemicals originally released by Madison-Kipp. Mr. Schmoller has also noted that with the aquifer as shallow as 18 feet below ground surface, groundwater is only about 10 feet below the basements of the nearby homes, thus the VOC groundwater contamination is only separated from the homes by a small interval of overlying soil (Schmoller Deposition,2012, pp. 39 and 44).

As noted by Dr. Ozonoff in his expert report, exposure to PCE at any concentration constitutes a health risk. If Madison-Kipp had conducted a prompt and thorough investigation after it first discharged these chemicals, but in no event later than WDNR's letter in 1994, the impacts on neighbors' homes could have been discovered much earlier than 2011. Although our understanding of the risks posed by vapor intrusion has grown since the 1990s, it was appreciated that vapor intrusion could be a problem at VOC-contaminated sites even before WDNA's 1994 letter. For example, EPA issued guidance documents related to vapor intrusion at contaminated sites as early as 1992 (EPA, 1992, Assessing Potential Indoor Air Impacts for Superfund Sites, EPA-451/R-92-002; EPA, 1993, Options for Developing and Evaluating Mitigation Strategies for Indoor Air Impacts at CERCLA Sites, EPA-451/R-93-012).

Based on my experience with VOC sites and vapor intrusion, this exposure pathway could easily have been discovered and addressed in the 1990s; thus, residents of the Class Area have endured at least an extra decade of exposure to these toxic chemicals as a direct consequence of Madison-Kipp's inaction. Due to the difficulty in cleaning up the widespread contamination (considering the particular hydrogeologic conditions in Madison and the recalcitrant nature of the chemicals; see Opinion 5) residents in the Class Area will continue to be threatened with exposure to Madison-Kipp's chemicals for many years into the future.

***Madison-Kipp has not adequately characterized the nature and extent of the contamination***

As noted in the depositions of the DNR regulator, Mr. Schmoller, and ARCADIS project manager for the investigation and remediation of the site, Ms. Trask, the horizontal and vertical extent of the groundwater contamination has not been defined. The sources and source areas of the PCE contamination at Madison-Kipp have not been fully defined and the extent of the soil contamination has not been defined. This is not

all that is lacking in the investigation. Since 1994 when Madison-Kipp was first required by WDNR to investigate its environmental problems it has:

- Failed to delineate the extent of PCE contamination in soil on its site;
- Failed to delineate the extent of PCE contamination in offsite soil, including in the Class Area;
- Failed to delineate the extent of PCB contamination in soil on its site;
- Failed to delineate the extent of PCB contamination in offsite soil, including in the Class Area;
- Failed to delineate the extent of PAH contamination in soil on its site;
- Failed to delineate the extent of PAH contamination in offsite soil, including in the Class Area;
- Failed to delineate the extent of PCE contamination in soil vapor on its site;
- Failed to delineate the extent of PCE contamination in offsite soil vapor, including in the Class Area;
- Failed to delineate the extent of PCE and other VOC contamination in shallow groundwater;
- Failed to delineate the extent of PCE and other VOC contamination in deep groundwater.

In summary, Madison-Kipp has not completed an adequate characterization of a single component of its multi-component environmental problem. It faces a major effort just to accomplish the state's 1994 requirement to "determine the horizontal and vertical extent of contamination" and an even greater task of actually cleaning up this problem. Mr. Schmoller of WDNR acknowledged that there is still uncertainty about all the sources of the contaminated soil vapor on the Madison-Kipp property. The off-site vapor contamination is due partly to vapor migration from contaminated soil and due partly to off-gassing from contaminated groundwater. I agree with Mr. Schmoller that Madison-Kipp has not determined the relative contribution from each of these sources to the vapor intrusion problem (Schmoller Deposition, 2012, pp. 33, 39). This uncertainty still persists, even after Madison-Kipp has had at least 18 years to evaluate these issues. There is also uncertainty as to the lateral and vertical extent of groundwater contamination. In fact, neither Madison-Kipp, nor WDNR seem to have even determined which way groundwater flows in the various aquifer zones under this site; nor have they determined which depth intervals of the aquifer are most transmissive (which are the depth intervals in which PCE and other VOC contamination is likely to have spread the farthest). If the scientist doesn't know which way groundwater is flowing (or how fast it is flowing), he/she can't know where to look for off-site groundwater contamination because dissolved contaminants typically migrate passively in the direction of groundwater flow.

Even the work that's been accomplished to date was frequently too little, too late. For example, many homes have only been tested for subslab vapor or indoor air one or two times. This is generally insufficient to measure the range of exposure faced by residents, thus insufficient to measure the risk

posed by such exposure. A single sampling event represents a measurement at a certain place and a certain time. Vapor measurements for volatile chemicals such as PCE are highly variable, meaning they can (and do) go up and down dramatically in response to wind, atmospheric pressure, open doors and windows, and operation of heating and cooling systems, among other things. VOC concentrations found under homes will vary temporally, just as the weather changes dramatically from one season to another and even from one day to another. As an analogy, a single temperature reading in Madison on a warm, sunny July day doesn't tell us much about what the weather will be like six months later, in January. In other words, a single measurement of a widely-varying parameter (such as temperature in Madison, WI or VOC vapor concentrations in a home) is not predictive of future conditions. In the same way, one or two subslab or indoor air measurements (even if they are low) can give a false sense of security because they are not able to capture the full range of variation that might be experienced over time and under different conditions. However, the fact that high concentrations of PCE and other VOCs have been found in on-site groundwater indicates that Class Members will continue to be exposed to and/or threatened by PCE vapors. (For additional information on the high levels of PCE found in groundwater at the site, see Opinion 5.)

By comparison, I looked at the historical soil gas numbers collected by RJN Environmental Services, LLC–Soil Vapor Sampling Locations and Data 2005-2009 on the DNR website. The Wisconsin Indoor Air Action Level for PCE is 6.4 ppbV. The subslab action level is 10 times this value, or 64 ppbV.[10] In 2005 at Madison-Kipp location VP-1N, the PCE ranged from a low of 26,018 to a high of 43,266 ppbV; in 2006 from a low of 12,424 to a high of 36,619; in 2007 from a low of 1,100 to a high of 40,000; in 2008 from a low of 890 to a high of 4,800; in 2009 from a low of less than 50 to a high of 1,300 ppbV. Under one of the homes in the Class Area, the PCE concentration ranged from 21 to a high of 1,100 at a single location. As noted on page 168 of Ms Trask's deposition, she was not even aware of the soil gas variability much less able to explain it. Clearly the PCE soil gas concentrations are extremely variable demonstrating the need for a more robust monitoring program, such as continuous soil gas monitoring, that can better capture the temporal variability of the vapor intrusion phenomenon.

Neither Madison-Kipp nor its environmental consultants have made an effort to ascertain how much PCE it used and how much it released over the years. Similarly, there is no evidence of any effort to catalog how much PCB was used at the site or the mass of PAHs that were used and/or generated from operations at the site. In my experience, a survey of historical records and practices is standard practice because it

[10] In my experience, this is rather high. For example, the Human Health Soil Gas Screening Level for PCE in California is 26 ppbV.

can be very helpful to define the magnitude of the releases, to help the environmental scientist define the likely scale of the subsurface problem, and to focus the investigation on areas most likely to have been impacted.

***Madison-Kipp's delay has allowed the contamination to spread offsite and allowed the problem to get worse***

In its original 1994 letter ordering Madison-Kipp to investigate and clean up its contamination, WDNR warned: "The longer contamination is left in the environment, the farther it can spread and the more difficult and costly it becomes to cleanup." By leaving contamination in the ground all these years, denying the problem and focusing on saving money, Madison-Kipp has allowed WDNR's prediction to come true and it is now faced with a more costly and complex cleanup than if it had listened to WDNR. Neighbors' exposure to Madison-Kipp's chemicals also could have been discovered many years earlier, which could have led to earlier efforts to mitigate this risk to human health. Instead, resident's exposure to Madison-Kipp's chemicals continued unabated for the 18 years of inadequate environmental work at this site (not to mention the many years prior to 1994 that the contamination existed but was not known to WDNR).

Now that the contamination has spread into the deeper bedrock aquifer and extends offsite, it will take many years to clean up. In fact, WDNR's project manager Mr. Schmoller indicated that it certainly would be a couple of decades before he would expect the groundwater contamination to be cleaned up (Schmoller Deposition, 2012, p. 51).

**OPINION 5. Because Madison-Kipp has no comprehensive plan to complete the investigation or to clean up the contamination, and has failed to confront the complexity and challenges of remediating the widespread contamination it has caused, additional remedial measures are required to characterize the site and mitigate the imminent and substantial endangerment to human health and the environment.**

As of this writing, there is no comprehensive scope of work for filling data gaps and completing the much-needed site characterization work for the soil, soil vapor, or groundwater at Madison-Kipp and beyond (Schmoller Deposition, 2012, p. 156). For example, dioxins are human carcinogens that are known to be associated with foundry operations and, to my knowledge, Madison-Kipp has not done any soil testing at all for dioxins.

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. In my experience with numerous local, state and

federal regulators, this is generally a requirement regardless of ultimate cleanup standards that might be applied for the subsequent remediation program. Exhibits 3 and 4 show the City of Madison's interpretation of PCE in shallow and deep groundwater, respectively. With regard to deep groundwater, Exhibit 4 shows there is no data at all to the west and east of Madison-Kipp so the extent of the PCE plume at this depth interval is completely unconstrained. There are monitoring wells north and south of the site, although all but one of these wells still contain PCE (at levels between 5 and 50 ug/L). Thus, the extent of the plume has not been fully delineated to the north or south.

The data show that PCE was released at the site and likely infiltrated into the groundwater in a "free product" or DNAPL (dense non-aqueous phase liquid), which is the most chemically potent form of PCE and the most difficult and expensive to clean up. DNAPL is a term used to describe the differences (both physical and chemical) between a liquid chemical (like PCE) and water (EPA, March 1991, Dense Non-aqueous Phase Liquids, Groundwater Issue). Chlorinated solvents like PCE and TCE have a density greater than water. Promoted by gravity, DNAPL migrates downward through preferential or permeable pathways such as soil pores, rock fractures or subsurface utility lines. By its very nature, DNAPL will find and then migrate through these preferential pathways.

EPA and other practitioners commonly use the so-called "1% rule" to indicate the presence of DNAPL in the subsurface. Briefly, the 1% rule states that if a chemical is detected in dissolved form in groundwater at a concentration corresponding to 1% or more of the solubility of that chemical in pure water, then it is likely that the pure phase (i.e. DNAPL) is present nearby.[11] The 1% benchmark for PCE corresponds to a concentration of approximately 1,500 ug/l. Evidence of the presence of DNAPL is found in monitoring well MW-5D. From August 2007 through December 2008, the concentrations for PCE in MW-5D was between 3,100 ug/l and 4,600 ug/l, which is consistently above the 1% rule. In fact, the concentrations at Madison-Kipp have been as high as 3% of this benchmark. Monitoring well 5D is screened in fractured bedrock. The National Academy of Sciences has indicated that fractured rock is the most complex of all hydrogeologic environments for characterizing and remediating DNAPL. As a member of the TAG (Technical Advisory Group) for the Interagency DNAPL Consortium (DOE, DOD, NASA, EPA), I am very familiar with DNAPL characterization and remediation.

The federal drinking water standard or MCL for PCE is 5 ug/L (or parts per billion). However, the MCLG (maximum contaminant level goal) is zero. MCLGs are public health goals and EPA seeks to establish the

[11] This test is employed because it is often difficult to directly observe DNAPL in the subsurface with conventional investigation techniques.

legally enforced MCL as close as possible to the MCLG.[12] This year, PCE has been detected in groundwater at the Madison-Kipp site at levels up to 2,600 ug/L (ARCADIS, June 1,2012, Bi-Monthly Progress Report, Madison-Kipp Corporation Site, 201 Waubesa Street, Madison, Wisconsin) which is lower than historical highs but still more than 500 times higher than the MCL and obviously much higher than the MCLG of zero. Because this concentration is in groundwater, it is likely to move off-site, and into the Class Area. It is troubling that the ARCADIS project manager was not even aware that the MCLG for PCE is zero (Trask Deposition, 2012, p. 163). It is hard to demonstrate a credible approach to groundwater cleanup if your environmental project manager is not aware of the regulatory framework and the likely cleanup goals.

The soil and groundwater contamination in the Class Area may be remedied to an acceptable level only through many decades of effort. This is because toxic chemicals have been transported off the Madison-Kipp Site by groundwater, windblown dust and sediment transport during rains and floods. This gave rise to a widespread and complex distribution of offsite contamination that will be difficult to map out and even more challenging to clean up.

Even after 18 years, many very basic facts are not known about the nature and extent of contamination under Madison-Kipp and the surrounding neighborhoods. ARCADIS, the characterization and remediation consultant, under contract to Madison-Kipp's law firm, has testified through Ms. Trask that the sources of the VOC contamination at Madison-Kipp have not been defined, that the soil contamination has not been fully defined, and the indoor VOC pathway has not been defined. ARCADIS does not know how much PCE is tied up in the soil on the Madison-Kipp property (Trask Deposition, 2012, pp. 159-160). Regarding groundwater, ARCADIS has also acknowledged that it does not know how much PCE is in the groundwater under the Madison-Kipp site or in the plume emanating from the Madison-Kipp site (Trask Deposition, 2012, pp. 159-160). In this section, I provide opinions about what additional investigation is still needed and provide a general remediation strategy for this site.

### *Additional groundwater investigation is required*

The WDNR regulator (Mr. Schmoller), the former Madison-Kipp Environmental Manager, (Mr. Lenz), and the ARCADIS Project Manager for the environmental characterization and cleanup (Ms. Trask) have all acknowledged that the horizontal, and vertical extent of groundwater contamination has not been defined even 18 years after the 1994 letter requiring Madison-Kipp to characterize the groundwater

[12] The MCL for a contaminant is sometimes higher than the MCLG (as is the case for PCE) because of difficulties in measuring small quantities of a contaminant, lack of available treatment technologies or if the cost of treating water to the level of the MCLG would be prohibitive.

contamination (Schmoller Deposition, 2012, p. 103; Lenz Deposition, 2012, p. 105; Trask Deposition, 2012, pp. 159-160).

The most glaring deficiency in the groundwater investigation is Madison-Kipp's failure to search for DNAPL in the aquifer. If the mass of DNAPL is large (as it must be, considering the amount of PCE that must have been dumped over the years) then it poses an essentially perpetual threat to groundwater quality, because of the large mass of contaminant concentrated in a small area. In this case, mapping out its location and depth in the subsurface is a major factor in understanding contaminant fate and transport and must be better understood in order to design an effective remediation strategy. I coauthored a pair of papers on this issue in 2001and 2002 (Kram, Keller, Rossabi and Everett, DNAPL Characterization Methods and Approaches, Parts 1 and 2). My coauthors and I explained in these papers that failure to remove or treat residual DNAPL may result in continued, long-term contamination of the surrounding groundwater which in turn means the long-term contamination of Class Member homes.

DNAPL characterization at this site should include 10 or more cone penetrometer (CPT) probe locations distributed across the Madison-Kipp property to a depth of no less than 100 feet in the areas historically known to have been dumping locations and/or areas with high PCE in shallow soil. In addition to fine-scale lithologic data, the CPT probes should include advanced sensors such as laser induced fluorescence (LIF)[13] or Raman Spectroscopy. Depending on the results of the initial set of CPT probes, Madison-Kipp should be prepared to test at additional locations if needed to more fully delineate DNAPL occurrences or other contaminant or hydrogeological conditions.

The specific flow pathways of contamination in fractured rock hydrogeology can be very different than regional groundwater flow estimated from groundwater elevations and groundwater contours. Since the fractured bedrock characterization has not been satisfactorily completed, the deep groundwater flow directions are not known with certainty. If one compares the PCE isocontours in Deep Groundwater Wells prepared by the City of Madison Engineering on 2/27/12 (Exhibit 4 of this report), one sees that the 50 ppb contour is a solid line yet there is no data in an east or west direction which would bound this contour and give any credibility to the solid line representation as definitive of the dimensions of the plume. Further, the 5 ppb isocontour is a dashed line that appears almost totally devoid of any deep groundwater data which would bound this isocontour line thus there is no defensible credibility to its projection.

[13] LIF is generally used to identify LNAPL at petroleum hydrocarbon sites: it cannot detect pure PCE. However, when PCE is used in degreasing operations (such as at Madison-Kipp) the PCE released to the environment is usually comingled with substantial petroleum residual from the degreasing operations, thus LIF is a useful tool for this site.

Therefore the true extent of the plume at the 5 ppb PCE contour is poorly defined in all four directions. This representation of the deep groundwater contour lines, when compared to the PCE isocontours in shallow groundwater developed by the City of Madison Engineering on 2/29/12, is very different (see Exhibit 3). In the shallow PCE contour map the 50 ppb contour is represented as a dashed line and the legend identifies the dashed lines as approximate. Further, the 5 ppb shallow contour line is represented as a dashed line and appropriately recognized in the legend. The 5 ppb isocontour is poorly defined and will require further characterization. The rational for further characterization is obvious when one compares the shallow groundwater map with the deep groundwater map. Clearly the rate of contamination migration is faster at some depths than others.

The lithology and compositional data gleaned from the CPT probes recommended above should provide better insight into the depth intervals of interest for mapping the dissolved groundwater plume. Depths of interest correspond to depths in which DNAPL is detected in onsite CPT probes and/or depths with especially high hydraulic conductivity. This is the combination of subsurface features that lead to the highest contaminant transport potential, thus have the potential for hosting the most extensive groundwater plumes. If existing wells are not screened in the depth(s) of interest, then new wells will need to be drilled even at the existing locations. In addition to redrilling existing locations, at least three multi-depth well clusters should be installed west of Waubesa Street; at least three multi-depth well clusters should be installed east of Marquette Street; at least two multi-depth well clusters should be installed north of well MW-10; and at least two multi-depth well clusters should be installed south of MW-6. Madison-Kipp should also be prepared to install more wells at a greater distance from the Site if data from the new wells show that the contamination extends beyond the new wells.

***Additional soil investigation is required***

The degree of contamination under the building is perhaps the most neglected data gap regarding onsite soil conditions at Madison-Kipp. WDNR agrees with my conclusion that this is a significant data gap (Schmoller Deposition, 2012, p. 246-247). I understand that ARCADIS recently has conducted some sampling under the building. This was an obvious place to look for contamination, and there is no excuse for waiting so long to conduct this essential component of the environmental investigation. The results of this sampling are not yet available, but I believe the scope of the work – 42 borings, I am told – will prove insufficient to adequately characterize a large industrial building such as Madison-Kipp. In my opinion, approximately 100 additional soil sample locations will be needed under the building. Soil samples should be analyzed (at minimum) for VOCs (including PCE), PAHs, total petroleum hydrocarbons, metals and PCBs. Results of the recent, modest round of sampling can be used as a guide for determining

appropriate locations for the more thorough soil investigation that I believe is needed. Another priority is that there needs to be a soil testing program for dioxins at onsite and offsite locations. This is because dioxins are human carcinogens that are known to be associated with foundry operations and, to my knowledge, Madison-Kipp has not done any soil testing at all for dioxins.

The on-site soil investigation for PAHs needs to be expanded in the southern parking lots (impacts resulting from oil spreading for dust suppression and also from PAHs likely emitted from Madison-Kipp's exhaust fans and stacks). In my opinion, this phase of the on-site investigation will require approximately 50 sample locations with samples collected from at least two depths at each location: one surface sample in the upper 6-inches of soil and one sample at a depth of 1-2 feet.

Although numerous off-site soil samples have been collected at the urging of WDNR, this program is far from complete and much more sampling is needed to delineate the extent that Madison-Kipp's various chemicals have invaded the surrounding neighborhoods.

The pattern of offsite soil impacts is likely very complex and difficult to predict because offsite soil contaminants were likely transported by a combination of windblown dust, condensation from PCE vented from the degreaser and sediment transport during rain events and floods. This investigation should include an assessment of prevailing winds in order to better understand the potential distribution of contaminants spread by airborne deposition. In my opinion, the offsite soil investigation should include a minimum of four sample locations on each residential lot, with samples collected from at least two depths at each location (one surface sample in the upper 6-inches of soil and one sample at a depth of 1-2 feet). If contaminants are detected in the deeper sample, then a third sample should be tested from that location, from a depth of 2-3 feet. All soil samples should be analyzed (at minimum) for VOCs (including PCE), PAHs, total petroleum hydrocarbons, metals and PCBs. Any residential lots that have not been sampled in at least four locations and tested for all contaminants of concern should be resampled in order to bring the soil sample density and analyte list up to the sampling protocol proposed here. The rationale for this sampling program is summarized below. Windblown contaminants can readily travel hundreds of feet or more from their emission source. For this reason, the area of investigation needs to be expanded and soil should be tested on all residential and commercial parcels within 600 feet of the Madison-Kipp property boundary in all directions[14]. If this off-site investigation is done in concentric phases, it may be possible to

[14]Further study of prevailing winds may allow a refinement of the shape of the off-site sampling area. According to the Wisconsin Wind Atlas (Naber-Knox, 1996) the prevailing wind in Madison blows out of the west-northwest in the winter and out of the south in the summer months. Contaminants are expected to travel farther from the source in the direction of the prevailing winds.

scale down this phase of the work by interpreting and responding to results from earlier rounds of sampling. For example, if all properties 500 feet from Madison-Kipp are found to be clean, then the properties 600 feet from Madison-Kipp can be spot-tested with (for instance) just one sample location for each parcel instead of four sample locations. The area for this off-site sampling survey is provided in Exhibit 6.

As of September 2012, PAHs have been found at every off-site property sampled (see Exhibit 7). Madison-Kipp almost certainly released PAHs to the environment. Petroleum-based lubricants used on die-cast molds are partly combusted each time molten metal is injected into a mold. PAHs are formed during this combustion process and would have been vented to the atmosphere. Madison-Kipp's current consultant, ARCADIS, has recommended that cleanup in the neighborhood not be driven by the widespread PAH contamination because the PAHs can originate from numerous sources (including backyard grilling), not just Madison-Kipp. If one wanted to identify the source of the PAHs, there are well known forensic techniques such as hydrocarbon fingerprinting which could have provided insight into the source of the PAHs. It has been known for at least 50 years that benzo(a)pyrene is a potent chemical carcinogen. This is one of the PAHs identified in the soil at neighboring properties. Since PAHs are a substantial human health risk, it is unacceptable that ARCADIS would find elevated PAHs everywhere it looked, yet try to trivialize the issue by suggesting the PAHs are the result of back yard grilling activity or otherwise blaming the neighbors. Clearly further forensic inquiry was required in this situation before ARCADIS could reach such a conclusion, especially in the light of compelling evidence showing that Madison-Kipp is the source of the PAHs. For example, ARCADIS could have looked at the Madison-Kipp oil and gas purchases on a year-round basis to determine if the PAHs released from the stacks and vents at Madison-Kipp were cyclic..

The PAHs were identified nearly everywhere they were sampled and the distribution of PAHs can be attributed to emissions from Madison-Kipp's die cast operations and spreading of hydraulic fluids containing the PAHs, PCE and PCBs on the gravel topped parking lots towards the north central part of the facility and the (yet to be characterized) old parking lot in the southwest part of the facility (bearing in mind however that the southwest part of the facility parking lot has been partially covered over by a building). I personally walked along the very narrow walkway between the Madison-Kipp facility and homes at 269-233 East Waubesa Street. While standing behind the home at 233 E. Waubesa Street, I took photos of large exhaust fans at Madison-Kipp (see Photo 22) which clearly showed they were dripping with petroleum residues. I further looked at the concentrations of PAHs in the backyards of the homes immediately adjacent to these exhaust fans. The highest concentrations of PAHs are located in the yards

directly adjacent to the exhaust fans, strongly suggesting that emissions from the fans were a source of the PAHs. ARCADIS, as an advocate for Madison-Kipp, is trying to avoid addressing the PAH problem, which would reduce the cost of further investigation and remediation. After completion of the off-site soil testing program referenced earlier in this report, all residential yards with PAH above WDNR's action level, should be excavated to remove the impacted soil and replaced with clean backfill.

During Madison-Kipp's operational history, polychlorinated biphenyls (PCBs) were widely used as a dielectric and in coolant fluids, for example in transformers, capacitors, and electric motors. Due to its environmental toxicity and classification as a persistent organic pollutant, PCB production was banned in the US in 1979 and internationally, by the Stockholm Convention on Persistent Organic Pollutants in 2001. According to USEPA, PCBs have been shown to cause cancer in animals and there is also evidence that they can cause cancer in humans. A number of peer reviewed health studies have also shown a causal link between exposure to PCB and non-Hodgkin's lymphoma.

A review of PCB detections as of September 2012 in soil indicates that PCBs were detected almost everywhere they were analyzed (see Exhibit 8). For example, every home between 102 and 154 West Marquette Street (with one exception) had hits of PCBs in its soil. Based on the toxicity of PCBs it is unconscionable that further PCB sampling was not conducted on the east side of Marquette and possibly further into the neighborhood. As discussed earlier, it has been acknowledged that the PCBs were contained in the hydraulic fluids that were spread on the gravel parking lots to control dust. The proximity of these lots (which I have walked) to the Class Area homes supports my opinion that overland flow contributes PCBs to the neighboring properties during rainfall events, flooding events and also by windborne dust. I find it disconcerting that PCBs were also found at every home, with one exception, sampled along the east side of Waubesa Street. Although the homes on the east side of Waubesa Street appear not to be down gradient of the eastern parking lot the same may not be said of the southwest parking lot. The southwestern corner of Madison-Kipp requires further investigation to determine if overland flow transported PCBs (and/or other chemicals) into the yards of homes on Waubesa Street. An investigation needs to be done to determine if the large vents that were dripping oil adjacent to the home at 233 E. Waubesa were spreading PCBs in atomized particulates. To date, I have not seen any discussion of the potential impacts of Madison-Kipp's large smoke stacks or large vents relative to contaminant distribution. The soil investigation proposed here and summarized in Exhibit 6 will address this concern.

***Additional vapor sampling is required***

Because the air in Class Area homes is being impacted by Madison-Kipp's volatile contaminants, it is obvious that indoor air quality in the facility itself is impacted or threatened. Soil vapor, subslab vapor

and indoor air sampling should be conducted in and under the Madison-Kipp facility. I recommend no fewer than 10 sets of vapor data be collected in and under the facility at widely-spaced locations, including any VOC hot spots identified from the soil sampling program discussed above. Each location should consist of a shallow soil vapor probe at a depth of approximately 5-feet, a deeper soil vapor probe above the water table, a subslab vapor probe and an indoor air sample near each cluster of probes. This work will help WDNR understand the exposure risk to Madison-Kipp workers from Madison-Kipp's chemicals.

Regarding off-site vapor measurements, the program needs to be expanded in geographic scope and it needs to be expanded to collect more time-series data. WDNR has, as of September 6, 2012, provided a summary of where PCE has been detected in subslab and/or indoor air (see Exhibit 9). Of the 51 residential properties sampled for VOC vapors, all but two had detections of PCE. Further, all the residential properties sampled on the northern part of Waubesa Street; all the residential properties sampled on the northern part of Marquette Street; and the residential properties sampled on the north part of Dixon Street, all showed hits for PCE. Clearly, the northern extent of the vapor contamination on Marquette, Waubesa, and Dixon Streets, has not been defined. If one looks at the vapor detections along Dixon Street, both north and south of Fairview Street, VOC vapors were detected in every location (with one exception). Clearly the easterly extent of the vapor plume has not been characterized at this stage. If one looks at the only sample taken on the east side of Cory Street it is clear that the western extent of the vapor contamination has not been characterized. If one looks at the home at 266 West Waubesa, we can see that a vapor mitigation system has been installed due to the presence of VOCs. However, none of the homes across the street or south of 266 Waubesa have been evaluated. If one looks at the southernmost homes on Marquette Street and Dixon Street that have been sampled, it is clear that PCE vapors have been detected. As such, further investigation of PCE vapors needs to be extended south on Marquette Street and south on Dixon Street. Based on information available to me, no samples have been taken along Atwood Avenue. The vapor sampling program needs to be expanded to the north, south, east, and west to better define the extent of Madison-Kipp's vapor plume and to better quantify the degree of impact on neighboring residential properties. According to ASTM Standard E2600, Vapor Encroachment Screening on Property Involved in Real Estate Transactions, a vapor encroachment screening for a property should include an evaluation of areas of concern up to 1/3 mile away as possible sources of vapor encroachment. I don't believe it's likely that Madison-Kipp's vapor contamination has spread as far as 1/3 mile from the facility, but at minimum, the next residential blocks out from the previous off-site sampling area should be tested, as shown on Exhibit 9.

At most offsite locations, there have been (at most) two vapor samples collected. Merely two samples are inadequate for determining the long term risk of VOC exposure at the neighboring properties. Recent guidance on vapor intrusion now focuses on the importance of time series data for vapors when trying to determine human health risk. Research on temporal variability of vapor concentrations was recently published in the peer reviewed Journal of Remediation, Winter 2011 edition. I was a co-author of that paper with Dr. Mark Kram and Dr. Peter Morris. The paper entitled, "Dynamic Subsurface Explosive Vapor Concentrations: Observations and Implications" is one of the fundamental papers on the dynamic behavior of subsurface vapors. This research concluded that parameters such as temperature and barometric pressure have a dramatic impact on the concentration of subsurface soil gases and their variability over time.

As a pilot program, I recommend that three to five of the homes with highest VOC detections in shallow soil or subslab vapor and three to five of the homes with the lowest VOC detections be equipped with continuous monitoring equipment. These homes should be monitored on a continuous basis for approximately one year in order to measure the true temporal variability in contaminant concentrations under neighbors' homes. After reviewing data from the pilot study, more informed decisions can be made regarding the need to equip more homes with continuous monitoring instruments or with vapor mitigation systems. The information currently available is incomplete but it suggests that all homes in the Class Area and beyond are threatened by unacceptably high levels of vapor contamination. Until the pilot program is completed and temporal variability of vapor contamination is better quantified, it is prudent to outfit all homes in the Class Area and all homes beyond the Class Area that have indication of pervasive vapor contamination (see Exhibit 10) with subslab depressurization systems. The decision framework employed by WDNR for approving installation of systems is reasonable except that it does not account for unmeasured temporal variability. For that reason, I recommend revising the decision framework to outfit all homes in the Class Area with vapor mitigation systems.

As noted in the deposition of Ms. Trask, wide fluctuations in the concentrations of PCE have already been noted at some locations associated with the Madison-Kipp site. This fact makes it self-evident that substantially more time series vapor analysis needs to be done on a larger neighborhood footprint.

### *Proposed remediation program*

WDNR has confirmed that there is not a specific remedial option chosen to deal with remediation of soil gas at Madison-Kipp (Schmoller Deposition, 2012, pp. 45, 117). ARCADIS has confirmed that there is no comprehensive plan to clean up soil contamination at the Madison-Kipp site and no time frame in mind as to when the contamination might be cleaned up. (Trask Deposition, 2012, p. 154). WDNR has

confirmed that there is no plan for remediation of either onsite or offsite soil at Madison-Kipp (Schmoller Deposition, 2012, p. 116).

A remediation strategy should be based on a firm understanding of the nature and extent of contamination, of the manner of past and present releases (if available) and of transport mechanisms responsible for the spreading of chemicals in each environmental medium. This frame of reference is frequently referred to as a "conceptual model." It is notable (and unfortunate) that neither Madison-Kipp nor ARCADIS have bothered to develop a conceptual model for this case. In my opinion, this is one reason the investigation and remediation has been so haphazard at this site: it has no foundation on an underlying understanding or theory of how the problem was created. The site investigation has not been completed for this site, so it is premature to specify all details of the future remediation program, although enough information is known to provide a general set of recommendations. Once the site investigation work is complete this strategy can be further refined and a formal design and cost estimate can be prepared.

In this section, I have outlined my opinions for a reasonable and effective remediation program for soil, soil vapor, and groundwater at and around the Madison-Kipp Site.[15]

***Soil.*** According to EPA, a presumptive remedy[16] for VOCs in soil is soil vapor extraction (SVE; assuming impacted soils are coarse-grained enough to transmit air under an applied vacuum; EPA, 1995, User Guide to the VOCs in Soils Presumptive Remedy). The most effective remedial technologies for PAHs and PCBs in shallow soil are either excavation or thermal desorption. If there is a risk of human exposure to these chemicals in shallow soil (such as at Madison-Kipp and in yards of the Class Area) then excavation is favored because it can be accomplished rapidly and with higher level of confidence that contaminant concentrations (thus human exposure levels) can be thoroughly and reliably reduced. For on-site soil, SVE is an appropriate technology for deeper soils in the vadose zone (i.e., above the water table) impacted with only VOCs. Shallower on-site soils are more likely to be impacted with multiple contaminants. This is because both PCBs and PAHs have an affinity to strongly sorb to soil grains and organics in soil, thus are generally restricted to surficial soil[17] and usually do not leach deeply into the soil profile. For this reason, I believe excavation and off-site disposal at a licensed treatment or disposal

[15] With the caveat that the additional site investigation work described above will improve our understanding of site conditions and may prompt me to revise the conceptual model, which in turn may require refinement of this remediation strategy.

[16] A "presumptive remedy" is a technology that EPA or some other authority believes will generally be the most appropriate remedy for a specified type of contamination, based upon past experience.

[17] Assuming the releases deposited PCBs and PAHs directly to the ground surface.

facility is the most appropriate approach for on-site shallow soil. For off-site shallow soil, excavation is the appropriate remediation technique because accomplishing cleanup rapidly should be a high priority for contaminated soil in residential yards where the risk of dermal contact and incidental ingestion are so great.

We do not yet know if deeper (deeper than a couple feet below the ground surface) off-site soil is contaminated with Madison-Kipp's VOCs. Deeper soil impacts would likely be restricted to residential properties immediately adjacent to Madison-Kipp because the transport mechanism for this type of occurrence would be lateral transport in the vadose zone along lithologic discontinuities and/or transfer of contaminants from groundwater to overlying soil and these transport mechanisms are generally capable of only limited lateral spreading. If deeper soil contamination is discovered in offsite locations, then the SVE program should be extended to cover these areas.

***Soil Vapor.*** Contaminated soil vapor on Class Area residential properties is a symptom of unmitigated VOC contamination of underlying or nearby soil and groundwater. Thus (in the long term) cleaning up VOCs in soil and groundwater will reduce the risk of vapor intrusion. In my opinion, it will take many years if not decades to complete the soil and groundwater cleanup at this site (even if Madison-Kipp changes its behavior and moves forward with a greater sense of urgency). Therefore, it is clear that interim (but robust) remedial measures are needed to protect homes from vapor intrusion into the foreseeable future.[18] The residential vapor mitigation systems need to be reliable and, at the least, each home identified in Exhibit 10 to this report should have a mitigation system.

We do know that mitigation systems have been sporadically provided on both sides of Waubesa and both sides of Marquette Street (see Exhibit 10). Further, we note that the northernmost properties on Waubesa, namely, 233 East Waubesa and 234 West Waubesa have mitigation systems (as represented by the WDNR September 6, 2012 map titled, Madison-Kipp Vapor Sampling Status). Further, as we look at the southern extent of Waubesa Street we see that 266 West Waubesa and 257 East Waubesa have vapor mitigation systems. The risk of vapor intrusion at 266 West Waubesa is virtually identical to the risk of vapor intrusion faced by the next-door neighbors. The fact that next-door neighbors have had lower detections may be an artifact of the inadequate sampling program. For this reason, all of the properties interspersed between homes that have already been equipped with mitigation systems should also be equipped with their own mitigation systems. By the same token, vapor mitigation systems were installed

[18] In addition, when data become available regarding VOCs under the Madison-Kipp building, we will be able to evaluate whether onsite vapor mitigation measures will be needed to protect Madison-Kipp's workers. Considering the previous findings in on-site soil and off-site soil vapor, there is a strong likelihood that this will be the case.

at the northernmost home on the east side of Marquette, yet several homes on the northwestern side of Marquette do not have mitigation systems. If one looks at the homes at 162-146 Marquette Street, it's clear that every home has a mitigation system yet homes immediately across the street do not have mitigation systems.

Based on the WDNR criteria for the installation of mitigation systems, I believe that a more complete and more representative subslab, and/or indoor air investigation would result in substantially more homes requiring mitigation systems. I base this recommendation on my many years of research dealing with soil gas migration. For approximately 15 years, I was the Director of the Vadose (soil) Zone Monitoring Laboratory at the University of California at Santa Barbara. In my laboratory we worked extensively on developing an understanding of soil gas migration through variably water saturated soils. In fact my first graduate student developed his Master's thesis researching soil vapor migration as a function of variable soil moisture contents. I note this point relative to soil moisture effects on soil gas migration because when I visited the homes in the Madison-Kipp neighborhood, I noted that some vapor mitigation systems were located directly adjacent to downspouts from the roof as noted in photo 28. These vapor depressurization systems will not work if there are high soil moisture levels such as would be expected in soils under downspouts after rainstorms. As a result, vapors could enter the home from areas further away from the downspouts. This is an example of why the mitigation systems need to be properly designed and installed and periodic subslab vapor and indoor air monitoring as well as periodic operational checks of these systems are required for these homes in order to confirm the reliability of the systems.

***Groundwater.*** WDNR has confirmed that there is not a specific remedial option chosen to deal with either shallow or deep groundwater at the Madison-Kipp site (Schmoller Deposition, 2012, pp. 45, 104). As noted above, cleaning up DNAPL in fractured bedrock is among the most difficult challenges in subsurface remediation. It will require many years and considerable funds to mitigate this serious environmental problem. I recognize that Madison-Kipp carried out a pilot program for chemical oxidation using permanganate and the results were promising. This or similar in-situ chemical oxidation technology is probably appropriate as a component of the groundwater remediation program for this site. However, to adequately treat contaminants from the widespread dumping and to account for uncertainties in contaminant distribution in the subsurface, the in-situ oxidation system would need to blanket essentially the entire Madison-Kipp site (including under the building). Further pilot testing can better refine such parameters as radius of influence for injection wells, but an initial estimate is that injection wells would need to be spaced at approximately 50-foot intervals. This would require approximately 120 wells spaced evenly across the site for injection of the oxidation compounds. However, we do not yet know how much

DNAPL is still present in the subsurface. If the proposed CPT/LIF investigation uncovers a large volume of DNAPL in or near the aquifer and if the DNAPL has accumulated in dead-end fractures or other portions of the porous medium that cannot be readily penetrated by the oxidation chemicals, then in-situ chemical oxidation would not work and six-phase heating would need to be applied in the high-concentration source areas of the aquifer. Six-phase heating is very expensive but it is one of the few (if not only) remediation technologies that can address the exceptional challenges faced at this site in the event in-situ oxidation is found to be insufficient.

Because of uncertainties in the groundwater flow direction, heterogeneity of the aquifer and variability of transmissivity of different aquifer zones at different depths, I believe it is important to include containment as a component of the groundwater remediation program in addition to in-situ oxidation (or six-phase heating). Groundwater containment is accomplished by pumping groundwater from one or more extraction wells in order to reverse the local groundwater gradient and prevent contaminants from spreading farther away from the site. This technique has the added benefit of recovering some contaminant mass from the pumped groundwater, which would be treated in an above-ground treatment system and discharged under permit, either to a storm sewer, sanitary sewer or to surface water.

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