AMBIENT PM_4 CRYSTALLINE SILICA SAMPLING
Wisconsin Industrial Sand Company
a subsidiary of Fairmount Minerals Ltd.
Maiden Rock, Wisconsin

Report Prepared for:

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Report Prepared by:

John Richards, Ph.D., P.E. and Todd Brozell, P.E.
Air Control Techniques, P.C.
301 E. Durham Road
Cary, North Carolina 27513
(919) 460-7811

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Air
Control Techniques, P.C.

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Acronyms

ACTPC	Air Control Techniques, P.C.
CFR	Code of Federal Regulations
DNR	Wisconsin Department of Natural Resources
EPA	U.S. Environmental Protection Agency
NIOSH	National Institute of Occupational Safety and Health
OEHHA	California Office of Environmental Health Hazard Assessment
PM2.5	Particulate matter having aerodynamic sizes equal to or below 2.5 micrometers as measured by EPA references methods
PM4	Particulate matter having aerodynamic sizes equal to or below 4 micrometers as measured by NIOSH references methods
PM4 CS	PM4 Crystalline Silica
PM4 PM	PM4 Particulate Matter
REL	Reference exposure level
SCAQMD	South Coast Air Quality Management District
SCC	Sharp Cut Cyclone

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Wisconsin Industrial Sand Company (WISC) has conducted PM4 crystalline silica sampling at three community-oriented sampling sites around the Maiden Rock underground mine and processing plant to help evaluate the impact of facility operations on ambient levels of PM4 crystalline silica beyond the fenceline. These data will help WISC provide information requested by neighbors in the Maiden Rock area.

1. SUMMARY

During the sampling period from March 11, 2013 through March 19, 2014, WISC conducted 374 twenty four hour sampling runs at a total of three community oriented sampling locations. This is one of the largest sets of ambient PM4 crystalline silica concentration data ever compiled.

All of the measured long-term average (12-month) PM4 crystalline silica concentrations at the community-oriented sampling sites were very low. The annual average concentrations of ambient PM4 crystalline silica at the three sampling locations ranged from 0.06 to 0.45 micrograms per cubic meter—values of 2.1 to 15.1 percent of the California Office of Health Hazard Assessment (OEHHA) chronic reference exposure level (REL) of 3.0 micrograms per cubic meter (70 year lifetime exposure)[1]. While this REL is the only useful comparison value at the present time, Air Control Techniques, P.C. believes that future ambient sampling and health studies will demonstrate that the OEHHA REL should be increased.

A set of three samplers was used to estimate the contribution of WISC emissions to the long-term average concentration of PM4 crystalline silica. Based on measured wind directions, Air Control Techniques, P.C. identified the downwind site during each sampling day. The upwind background concentrations were determined based on the arithmetic average of the concentrations measured at the other two sampling sites. The long-term average increase in the 24-hour downwind concentrations over the upwind background concentrations was 0.23 micrograms per cubic meter. The maximum observed increase in one of the 124 sampling days was 2.2 micrograms per cubic meter. These data indicate that WISC does not significantly increase the ambient PM4 crystalline silica concentrations downwind of the Maiden Rock facility.

Claims regarding possible ambient crystalline around sand mines stated by some individuals without the benefit of quality data are found to be false. Crystalline silica ambient air quality is excellent around the WISC facility.

The regional background concentrations of ambient PM4 crystalline silica contributed to the measured concentrations at the three sampling locations. The regional background concentrations were clearly indicated by sets of sampling days in which all three sampling locations had measurable PM4 crystalline silica concentrations regardless of the prevailing wind direction. The regional background concentrations are due to a variety of well-known sources of ambient PM4 crystalline silica, including (1) agricultural operations, (2) unpaved roads, (3) construction activity, (4) industrial sources, (5) sand on snow and ice-covered roads, and (6) the global transport of dust from the Gobi (China) and Saharan (Africa) deserts. Considering that crystalline silica comprises 12% of the earth's crust, any activity that disturbs rock or soil has the potential to contribute to ambient PM4 crystalline silica concentrations. The data compiled in this sampling program suggest that the combined contributions in Western Wisconsin from all of these sources are small and do not result in ambient concentrations that approach or exceed the OEHHA REL.

It was not the purpose of this sampling program to compile PM2.5 ambient air quality data. Nevertheless, the PM4 particulate matter concentrations determined as a preliminary step in the measurement of PM4 crystalline silica can be used as a surrogate for PM2.5 concentrations. The PM4 particulate matter size range includes all of the PM2.5 particulate matter (zero to 2.5 micrometers) plus the particulate matter in the 2.5 to 4.0 micrometer size range. The PM4 particulate matter data compiled at the three sampling locations indicate that there were no exceedances of either the 35 microgram per cubic meter 24-hour or the 12 microgram per cubic meter annual average PM2.5 National Ambient Air Quality Standards. Furthermore, the contributions of WISC emissions to the downwind PM2.5 concentrations averaged only 0.9 micrograms per cubic meter—a value within the precision limits of ambient particulate matter measurement methods.

The following general information is helpful in evaluating the results summarized above.
PM4 is particulate matter that has particle sizes equal to or less than 4 micrometers as measured by the National Institute of Occupational Safety and Health (NIOSH) Method 0600. PM4 crystalline silica is PM4 particulate matter that has been analyzed using NIOSH Method 7500 X-ray diffraction to determine the total crystalline silica content. Ambient air is air in areas accessible to the public. In-plant air is air in areas accessible only to employees and visitors to a Mine Safety and Health (MSHA) regulated facility.

Ambient PM crystalline silica was measured to be consistent with the PM4 crystalline health effects literature and established industrial hygiene PM4 crystalline silica sampling and analytical procedures. To measure ambient air PM4 crystalline silica, WISC used EPA Reference Method PM2.5 samplers (Thermo Fisher Partisol 2000i, U.S. EPA Designation FRPS-0498-117) satisfying the design and performance requirements of 40 CFR Part 50, Appendix L and modified for PM4 crystalline silica sampling based on Richards and Brozell.[2] An accredited laboratory, R. J. Lee, Inc. (R. J. Lee), analyzed the Partisol 2000i filter samples for PM4 crystalline silica by X-ray diffraction in accordance with the National Institute of Occupational Safety and Health (NIOSH) Method 7500. The Partisol 2000i EPA reference method samplers operated in accordance with the extensive quality assurance guidelines specified in the EPA Quality Assurance Guidance Document 2.12 dated November 1998.

The sampling and analytical procedures used in this program provided an extremely sensitive measure of ambient air PM4 crystalline silica concentrations. The lower limit of quantification was 0.3 micrograms of PM4 crystalline silica per cubic meter for ambient air samples of 16 cubic meters obtained over a twenty-four hour period.

The sampling program within the community of Maiden Rock consisted of measuring the ambient air PM4 crystalline silica concentrations at three widely-separated locations. The Northeast sampling location was to the east of the processing area and the underground mine near the WISC eastern fenceline. The Southwest sampling location was on the south corner of the WISC property adjacent to the plant processing area and near State Road 35. The In-town sampling location was on County Road S in the Village of Maiden Rock.

All three sampling locations satisfied the siting guidelines of the U.S. EPA as specified in 40 CFR Part 58, Appendix E with the exception of the requirement to locate samplers at a distance more than 10 times the height of the nearest tree. In the heavily forested Maiden Rock area, there is essentially no location that meets this one criteria. There was free air movement to the samplers from all 360 degrees. Wind speed and wind direction sensors installed at a three-meter elevation provided the site-specific meteorological data needed to evaluate wind directions at each of the three sampling locations.

2. SAMPLING PROGRAM DESCRIPTION

2.1 Study Participants

WISC personnel and a member of the Maiden Rock community shared responsibility to operate the samplers. Sampling was conducted every third day on the EPA recommended sampling schedule. Air Control Techniques, P.C. personnel (1) provided specifications for the PM4 samplers, (2) modified the samplers for PM4 operation, (3) conducted quarterly audits, (4) provided procedures for filter sampling handling, and (5) provided training to the sampler operating personnel in the use and maintenance of the samplers.

2.2 Community-Oriented Sampling Program Design

The study involved three community-oriented samplers located on three separate sides of the facility. The Northeast side was on residential property on the hill above the underground mine and processing area. This site was inside the fenceline in an open area. The Southwest site was on residential property adjacent to both State Road 35 and the plant processing area. This site was in an area located away from the drip lines of trees and other vegetation on the property. The in-town site was on residential property adjacent to County Road S in the Village of Maiden Rock. These sampling locations are marked on the aerial view of the site shown in Figure 2-1.

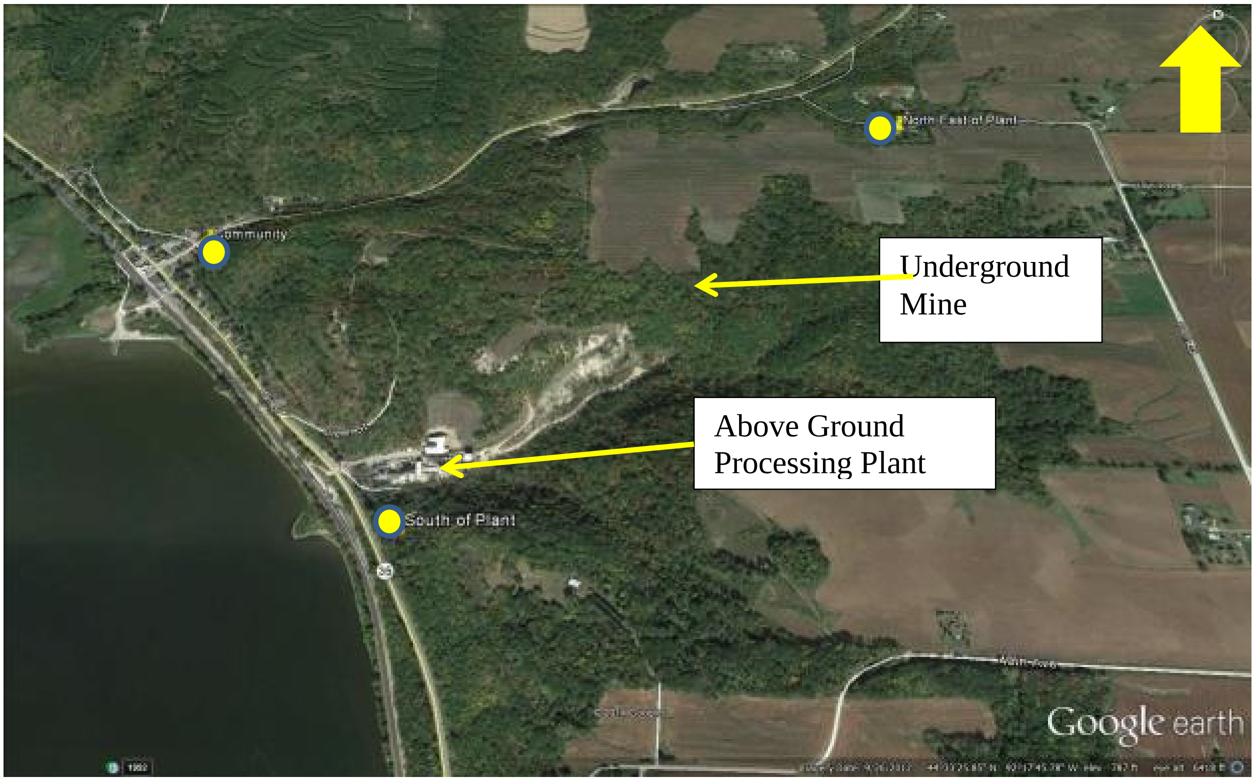

Figure 2-1. Overview of Maiden Rock, Wisconsin
(Source: Google Earth)

The contributions of the WISC facility to ambient concentrations of PM4 crystalline silica were evaluated by comparing the day-by-day concentrations measured at the three widely-separated sampling locations. Only one of the three sampling locations was downwind of the facility on any specific day. Accordingly, two sampling locations provided background data while the third provided data concerning the contribution of the facility plus the background concentration.

The average PM4 crystalline silica concentration measured during the one-year study at each of the three community-oriented sampling locations was compared to the California OEHHA chronic reference exposure level (REL) of 3.0 micrograms per cubic meter (μg/M^3) over a 70-year period. In making this comparison, Air Control Techniques, P.C. is not endorsing the OEHHA REL—it is simply the most commonly listed guideline concentration. It is also important to note that single 24-hour values measured in this study have not and should not be compared against the 70-year lifetime exposure REL published by OEHHA. Single day concentration excursions above 3 μg/M^{3}are normal and expected in areas having long-term average (year to multi-year) concentrations of PM4 crystalline silica well-below 3 μg/M^3.

As shown in Figure 2-2, the above ground processing area of the WISC facility is located between two large ridges oriented from the west-southwest to the east-northeast. The ridges rise approximately 300 feet above the entry road to the facility. Due to these ridges, winds from the north, northeast, and east are channeled downslope to the south sampling location. Winds from the northwest, west, and southwest are channeled upslope to the northeast sampling location.

Due to the parallel high ridges in the river valley, the Village of Maiden Rock is isolated from the upslope and downslope air flow over the WISC facility.   The heavy canopy of vegetation on the ridge between WISC and the Village of Maiden Rock also serves to minimize winds from the WISC facility to the Village of Maiden Rock.

Figure 2-2. Hilly Terrain Around Maiden Rock and the WISC Facility
(Source: Google Maps)

2.3 Sampling Locations

Each of the three monitoring locations met the U.S. EPA requirements for microscale sampling sites with the exception of the separation distance from trees. The sampling locations were located a sufficient distance from roads, were not under the drip lines of overhead vegetation, were free of ground-level releases of fugitive dust around the samplers, and were at least 2 meters above ground level.

Northeast Sampling Location—The Northeast sampling location shown in Figure 2-3 was on a residential property currently owned by WISC. This site was east of the processing plant and the underground mine. The sampler was located away from the public road and in an area away from the driplines of several small trees.

Figure 2-3. Overview of the Northeast Sampling Location

The Northeast sampling site was surrounded on three sides by farm fields. During tilling and harvesting, fugitive dust emissions from these fields could create a bias to higher-than-true PM4 crystalline silica concentrations. All accessible areas on the east side of the WISC facility were subject to this possible high bias.

The Northeast sampler is shown in Figure 2-4. The sampling location was as far as possible from the trees shown in the background and to the right of this photograph. These trees did not block air flow to the sampler, and the vegetation canopy had little, if any, effect on the ambient air reaching this sampler.


Figure 2-4. Photograph of the Northeast Sampler

Line power for this sampling location was provided from the adjacent house. A Davis Weather Vue® wind speed and direction sensor was mounted on the sampler.

Southwest Sampling Location—The Southwest sampling location shown in Figures 2-5 and 2-6 was on the southwest corner of the WISC property in an area close to State Road 35 and within 200 feet of the active processing area.

The sampler was mounted two meters above the ground on a small platform. A Davis Weather-Wizard Vantage Vue® wind speed and direction sampler was located at this sampling site. A 110 VAC electrical line from the adjacent house provided the electrical power for the PM4 sampler and the wind speed and wind direction monitor. The sampler was located as far as possible from trees located on the north, east, and south sides of the property.

Due to its location, the Southwest sampling location was downwind of the WISC processing facility and underground mine when the winds were coming from the north, northeast, and east. This sampling location was downwind of the WISC rail loading facility when the winds were coming from the northwest.

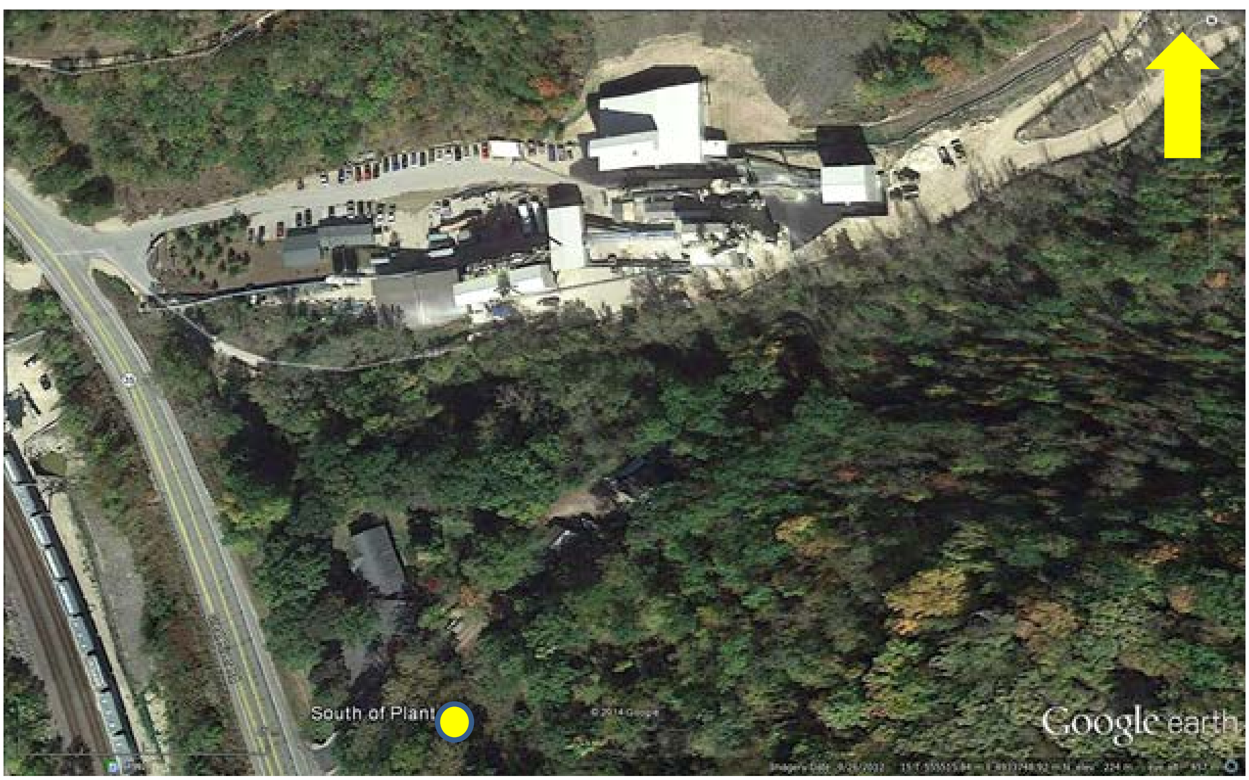

Figure 2-5 Aerial View of the Southwest Sampling Site and the WISC Processing Facility

Figure 2-6. Southwest Sampler Location

In-Town Monitoring Location—The in-town sampling location shown in Figures 2-7 and 2-8 was on the south side of County Road S in the front yard of an ambulance garage. This sampler was located as far as possible from the edge of the road without being too close to the building.

Figure 2-7. In-Town Sampling Location
(Source: Google Earth)

Figure 2-8 In-Town Sampling Location

In-Plant Sampling Location—For a six-month period prior to the start of the one-year sampling program, WISC operated two of the PM4 crystalline silica samplers at an in-plant location shown in Figure 2-9. This location did not meet EPA sampling site criteria in that the samplers were located close to both an entry road and an in-plant access road. The sampling location was also affected by wind flow issues. The shape of the valley inlet at this location resulted in swirling wind on a frequent basis. The swirling pattern was both visible and demonstrated by inconsistent indicated wind directions by flags and other wind indicators.

The in-plant location was used until WISC could get access to two residential properties located on the northeast and southwest sides of the plant. Air Control Techniques, P.C. recommended that the samplers be moved from the in-plant to the two community-oriented locations as soon as they were available in mid-March 2013.

Figure 2-9. In-Plant Sampling Location (August 2012 to March 2013)

The in-plant samplers served as area monitors for in-plant concentrations. Throughout the six-month period that these samplers were in this location, the in-plant PM4 crystalline silica concentrations were well below the MSHA occupational exposure limit. However, the measured concentrations were biased high due to the swirling winds occurring frequently at this part of the facility.

In March 2013, the two samplers shown in Figure 2-9 were moved to the Northeast and Southwest near-residential locations.

2.4 Study Procedures

Sampling Program Matrix—The matrix of the tests at each of the sampling locations is summarized in Table 2-1.

Partisol 2000i Samplers—WISC used Thermo Scientific Partisol 2000i (Partisol) low-vol Federal Reference Method filter samplers for PM4 crystalline silica monitoring. The primary advantages of the Thermo Scientific samplers are (1) accurate and reliable sample flow control, (2) well-designed filter cassette to minimize incidental dust exposure, and (3) memory sufficient for at least seven one-day sampling periods without the need for downloading. The only disadvantage is the need for line power to support the electrical demand of these samplers.

The Partisol samplers used to measure PM4 crystalline silica were adjusted by Air Control Techniques, P.C. to operate at 11.1 liters per minute rather than 16.7 liters per minute to adjust the $PM_{2.5}$ sharp cut cyclone (SCC)[1] 50% cut size to 4.0 rather than 2.5 micrometers. This is needed to provide data consistent with NIOSH Method 0600. The accuracy of the SCC cut size

[1] Air Control Techniques, P.C. is using sharp cut cyclones rather than very sharp cut cyclones because we measured the cut size of sharp cut cyclones operating at 11.1 liters per minute in 2005 during the method development project.

at a sampler flow rate of 11.1 liters per minute has been determined based on a method development study conducted by Air Control Techniques, P.C.[2]

Table 2-1. Sampling Program Matrix Based on Every-Third-Day Sampling					
Sampling Location	Sampler	Analyte	Number of Runs	Hours	Analytical Method
Northeast	Partisol 2000i	PM4 Crystalline Silica	124	24	Gravimetric, NIOSH 7500
	Davis Weather Wizard	Wind Direction and Wind Speed	124	2-hour average data for 24-hours	N/A
Southwest	Partisol 2000i Primary	PM4 Crystalline Silica	124	24	Gravimetric, NIOSH 7500
	Davis Weather Wizard	Wind Direction and Wind Speed	124	2-hour average data for 24-hours	N/A
In-Town (Community)	Partisol 2000i	PM4 Crystalline Silica	124	24	Gravimetric, NIOSH 7500
	Davis Weather Wizard	Wind Direction and Wind Speed	124	2-hour average data for 24-hours	N/A

The Partisol 2000i samplers have a lower limit of quantification PM4 crystalline silica concentration of 0.3 micrograms per cubic meter. This is based on a 5 microgram minimum detectable limit specified by R.J. Lee Group, Inc. (R. J. Lee) for NIOSH Method 7500 X-ray diffraction. The 5 microgram crystalline silica detection limit is equivalent to 0.3 micrograms per cubic meter based on a 24-hour duration sample at 11.1 liters per minute (15.98 cubic meters).

The Partisol 2000i instruments modified for PM4 sampling operated in full accordance with 40 CFR Part 50 Appendix L procedures except for (1) a sample flow rate of 11.1 liters per minute, (2) the use of a PVC filter as specified by NIOSH Method 7500, and (3) gravimetric analysis of the filters by NIOSH Method 0600. The PVC filters had a pore size of 5 micrometers as specified by NIOSH Method 0600. The filter samples were tested for PM4 crystalline silica using NIOSH Method 7500. The analyses included three forms of crystalline silica: quartz, cristobalite, and tridymite. This is the most sensitive and accurate method available for measuring ambient PM_4 crystalline silica concentrations.

Partisol 2000i Air Sampler Flow Control and Flow Recorder System—The Partisol samplers contained sensors to continuously measure the ambient temperature and pressure. The system's electronics used values from these components to adjust the set point of the sampler's mass flow controller to continuously maintain the proper volumetric flow rate.

The Partisol 2000i instruments controlled the ambient air flow rate on a volumetric basis under all ambient conditions. The PM4 sampling data were reported based on actual temperatures and pressures as required by U.S. EPA 40 CFR Part 50, Appendix L.

The recorded actual flow rates were logged on the Partisol in two different files. The files were designated as filter data files and interval data files, both of which were downloaded to a portable computer or USB drive. The filter data files contained averaged filter run data for a particular filter. A copy of the filter data and audit procedure datasheets is contained in the attached file titled "Appendix C Audit and Sampling Datasheets." The filter file contains the following data.

- The Filter ID number
- The Cassette ID number
- The set starting time/date at which the unit was set to begin sampling
- The actual starting time/date at which the unit actually started sampling
- The set ending time/date at which the unit was set to stop sampling
- The actual ending time/date at which the unit stopped sampling
- The sampler elapsed sampling time
- The sampler minimum, average, and maximum actual volumetric flow rate during the sampling period
- The coefficient of variation (%CV) as calculated as the standard deviation of the five-minute flow rate averages divided by the average flow rate divided by 100
- The total volume (m^3 at actual conditions) sampled through the collection filter
- The total volume (m^3 at standard conditions) sampled through the collection filter
- The sampler minimum, average, and maximum ambient temperatures (°C) encountered during sampling
- The sampler minimum, average, and maximum filter temperatures (°C) encountered
- The sampler minimum, average, and maximum ambient pressures (mm Hg)
- The maximum filter temperature (°C) difference between the filter and ambient temperature during and after sample collection as well as the date and time
- Site ID1 and ID2 fields that displayed the WISC designated sampling location and instrument numbers
- Status codes
- The valid sampler elapsed sampling time
- The sampler minimum, average, and maximum percent relative humidity

The Partisol 2000i air samplers also stored five-minute averaged ambient temperatures, filter temperatures, ambient pressures, and flow rate as interval data. The samplers displayed the following information in the Interval Data screen.

- The ending time/date of the five-minute interval information being displayed
- The five-minute average of the ambient temperature (°C)
- The five-minute average of the filter temperature (°C)

- The five-minute average of the ambient pressure (mm Hg)
- The five-minute average of the flow rate (liters per minute)

Partisol 2000i Air Sampler Filter Changes and Instrument Checks—The Partisol-2000i air sampler accommodates 47 mm filters installed in filter cassettes. The use of filter cassettes reduced the risk of filter contamination during installation and removal from the sampler. The recovered filter cassettes were transported in cases to further protect the filter samples. The filter samples were recovered according to the NIOSH Method 600 and U.S. EPA Quality Assurance Guidance Document 2.12, Section 7.

During the every-sixth day filter changes, the sampler operator performed any required maintenance of the system's PM10 inlet and SCC. The information contained in the Partisol 2000i air sampler filter data screen and interval data screen was downloaded electronically to a portable computer or USB drive.

Partisol 2000i Air Sampler Routine Maintenance Procedures—Routine maintenance of the Partisol-2000i air sampler was performed by the sampler operator. These maintenance activities were performed at the intervals consistent with U.S. EPA 2.12 Quality Handbook.

- Filter cassettes were inspected for contamination after every use. They were wiped with a clean dry cloth as required.

- The upper and lower cassette seals were inspected every time a filter was exchanged. The seals were wiped with a clean, dry cloth as required. The seals were inspected at least once a month for drying and cracking and were replaced if necessary.

- An internal leak check was performed (1) once every two weeks, (2) before the start of the sampling program, and (3) following the completion of the sampling program.

- An external leak check was performed (1) once every two weeks, (2) before the start of the sampling program, and (3) following the completion of the sampling program.

- The SCC and the PM10 inlet were cleaned every four weeks.

- The cabinet inlet was cleaned every four weeks.

- The clock, O-ring seals, PM10 inlet, and transport cases were checked every four weeks.

- The air screens located under the sampler's rain hoods were cleaned at least every six months of operation.

Computation of Mass Concentration—The following formulas were used to calculate the average mass concentration of PM4 crystalline silica during the sampling periods. The total sampling time was maintained between 23 and 25 hours as required by 40 CFR Part 50 Appendix L Section 3.3.

$$PM_4 = \frac{10^6\left(W_{final} - W_{initial}\right)}{Q_{Actual}} \qquad \text{Equation 1}$$

Where:

PM4 = Mass concentration of PM4, micrograms per actual cubic meter

W_{final} = Final weight of filter collecting PM4 particulate matter, grams

$W_{initial}$ = Initial weights of filter collecting PM4 particulate matter, grams

Q_{Actual} = Actual volumetric flow through sampler during the sampling period, actual cubic meters

Mass concentrations of quartz, cristobalite, and tridymite were calculated as indicated in Equation 2 for each sample.

$$PM_4CS = \frac{\left(WCS_{final} - WCS_{blank}\right)}{Q_{Actual}} \qquad \text{Equation 2}$$

Where:

PM_4 CS = Mass concentration of PM4 crystalline silica, micrograms per actual cubic meter

W_{final} = Combined weight of quartz, cristobalite, and tridymite on the filter sample, micrograms

W_{blank} = Average field blank total value of quartz, cristobalite, and tridymite if above detectable levels, micrograms

Q_{Actual} = Actual volumetric flow through sampler during the sampling period, actual cubic meters

PM4 Filter Conditioning and Laboratory Analysis—R. J. Lee conducted the NIOSH Method 0600 gravimetric analyses and the NIOSH Method 7500 X-Ray Diffraction (XRD) crystalline silica analyses of the filters used in the monitoring program. R. J. Lee is an accredited laboratory for NIOSH Method 7500 analyses and has extensive experience with this analytical method.

R. J. Lee used Mettler-Toledo UMT2 & MX-5 microbalances capable of measuring down to 0.10 micrograms for filter pre- and post-weighing in accordance with NIOSH Method 0600. R. J. Lee has a reporting limit of 0.10 milligrams. This is above the minimum detectable PM4 particulate matter concentration anticipated based on PM2.5 and PM10 concentrations commonly measured in the upper Midwest.

The gravimetric data were stored directly from the balances to their gravimetric database. The microbalances were linked to PCs via application-specific software to eliminate vulnerability to manual transcription errors.

R. J. Lee calibrated their microbalances daily using ASTM Class 1 calibration weights. Filters were pre-weighed, and the weights were automatically stored in a database. Every tenth filter was re-weighed and compared to the previous result. The balance room was monitored daily for temperature and humidity.

R. J. Lees's gravimetric laboratory is accredited by numerous states, a list of which can be found at http://www.rjlg.com/about-us/accreditations.aspx.

Following gravimetric analysis, the filters were prepared by R. J. Lee for crystalline silica analysis by XRD in accordance with NIOSH Method 7500. The analyses included quartz, cristobalite, and tridymite.

NIOSH Method 7500 for crystalline silica calls for digesting the filter media and re-depositing the dust onto a silver membrane filter for analysis. R. J. Lee has two four-chamber plasma ashers, each of which is able to handle up to 16 samples at once. R. J. Lee is one of only a few laboratories that uses low-temperature plasma ashing. This procedure is much more efficient and reliable than a muffle furnace and much safer and more effective than tetrahydrofuran digestion. The low temperature of the plasma also does not convert amorphous silica to cristobalite or induce other high-temperature chemical reactions that are possible in a muffle furnace.

R. J. Lee uses a custom filtration system that creates an 11-mm filter deposit onto the silver membrane. This smaller, more concentrated deposit size increases the resolution of the scan by increasing the signal/noise ratio of the resulting diffraction pattern.

The X-ray analysis laboratory has two X-ray diffractometers. R. J. Lee has a PANalytical Cubix Pro unit dedicated to air silica analysis and a PANalytical X'Pert Pro unit, which handles both bulk and air silica analyses. Both units have automated sample changers allowing them to run around the clock. The diffraction data from both units were collected and stored digitally. Areas of the diffraction peaks were measured by the analyst using a commercial software package. R. J. Lee does not have confidence in or use automated analysis programs to measure the diffraction patterns. All of the samples are evaluated and measured manually for evaluating the numerous natural interferences that can be present in a diffraction pattern.

R. J. Lee reported all three forms of crystalline silica (quartz, cristobalite, and tridymite) for each sample. There are two major interferences: mica and feldspar. Mica (biotite/muscovite) is a common accessory mineral found in many rocks and soils. It is the primary interference for quartz. Since R. J. Lee evaluates diffraction peaks specific to mica for each sample, it was possible to determine if a sample contained mica. If the main diffraction peak for quartz was too obscured by the mica, then a secondary or possibly a tertiary peak was measured. Feldspar (orthoclase-/microcline/plagioclase) is the most common mineral found in the earth's crust. It is a primary interference for cristobalite. The differentiation of feldspar from cristobalite is one of the most common sources of error made by inexperienced laboratories. If a diffraction peak occurs in this range, then a comprehensive pattern scan is done of the sample. A whole pattern scan is required to identify the cristobalite from the feldspar. Information concerning the geologic or industrial setting is also very important in determining cristobalite from feldspar.

R. J. Lee maintains a 2004 version of the ICDD powder diffraction database. This database contains over 150,000 crystalline compound standard reference molecules assembled by the Joint

Council to Powder Diffraction Standards (JCPDS). Qualitative analysis of air and bulk samples is done by matching the observed diffraction pattern to reference patterns stored in the database**.**

3. AMBIENT PM4 CRYSTALLINE SILICA CONCENTRATIONS

3.1 Long-Term Average PM4 Crystalline Silica Concentrations—All of the long-term (12 month) ambient PM4 crystalline silica concentrations measured during this sampling program at the WISC facility were very low as summarized in Table 3-1

Table 3-1. Long-Term Average Ambient PM4 Crystalline Silica Concentrations, March 2013-March 2014

Sampling Location	Average Long-Term PM4 Crystalline Silica Concentration, µg/M^3	Percent of OEHHA Chronic Reference Level µg/M^3
In-Town	0.06	2.1
Northeast	0.13	4.2
Southwest	0.45	15.1

As indicated in Table 3-2, the long-term (12-month) average concentrations are only a small fraction of the OEHHA long-term reference level of 3.0 µg/M^3.

The three PM4 crystalline silica samplers measured 24-hour average PM4 crystalline silica levels ranging from levels below the LOQ to a maximum of 2.4 micrograms PM4 crystalline silica per cubic meter. This maximum measured value occurred on March 11, 2013.

The PM4 crystalline silica concentrations measured at all three sampling locations from March 11, 2013 through March 18, 2014 are summarized in Table 3-2. Values below the LOQ are shown as zeroes in this table. 39.8 to 84.2 percent of the 24-hour concentration values measured at the three sites were below the LOQ of 0.3 µg/M^3. These values were treated as zeros in Table 3-2.

If the data from the preliminary sampling period from August 2012 through March 2013 are added to the data set, the long-term (18 month) average ambient PM4 concentration at the In-Town sampling location changes from 0.06 to 0.08 µg/M^3—a value that is 2.7% of the OEHHA long-term REL. The In-town concentration data for August 2012 through March 2013 are provided in Appendix A to this report.

Table 3-2. Ambient PM4 Crystalline Silica Data

Date	In-town		Southwest		Northeast		Downwind Location		Back-Ground	Difference
	PM4 CS µg/M³	Wind Dir.	PM4 CS µg/M³	Wind Dir	PM4 CS µg/M³	Wind Dir	Site	PM4 CS µg/M³	PM4 CS µg/M³	PM4 CS µg/M³
3/11/2013	0.0	ENE	1.7	ESE	2.4	ND	Southwest	1.7	1.2	0.5
3/14/2013	0.4	NW	0.4	SSW	0.4	WSW	Northeast	0.4	0.4	0
3/17/2013	0.0	WNW	0.4	WNW	0.0	ESE	Northeast	0	0.2	-0.2
3/20/2013	0.0	SE	0.4	SW	0.0	WNW	Northeast	0	0.2	-0.2
3/23/2013	0.0	N	0.9	WSW	0.0	NE	Southwest	0.9	0	0.9
3/26/2013	0.0	N	0.6	WNW	0.0	W	Northeast	0	0.3	-0.3
3/29/2013	0.0	N	0.7	NNE	0.0	SSE	Southwest	0.7	0	0.7
4/1/2013	0.0	SE	0.4	NE	0.0	WNW	Southwest	0.4	0	0.4
4/4/2013	0.0	SSW	1.1	SSW	0.3	SSW	Northeast	0.3	0.55	-0.25
4/7/2013	0.0	SE	0.0	NE	0.0	SW	Northeast	0	0	0
4/10/2013	0.0	WNW	0.0	NNW	0.0	NNE	Southwest	0	0	0
4/13/2013	0.0	SE	0.0	WSW	0.0	SW	Northeast	0	0	0
4/16/2013	0.0	SE	0.0	SW	0.0	WSW	Northeast	0	0	0
4/19/2013	0.0	SE	0.8	NE	0.0	W	Southwest	0.8	0	0.8
4/22/2013	0.0	NNW	0.7	SSW	0.0	NNW	Northeast	0.7	0	-0.7
4/25/2013	0.0	SE	0.0	SW	0.0	SW	Northeast	0	0	0
4/28/2013	0.4	WNW	0.6	ENE	0.0	SE	Southwest	0.6	0.2	0.4
5/1/2013	0.0	ENE	2.2	NE	0.0	WNW	Southwest	2.2	0	2.2
5/4/2013	0.0	NNW	0.7	NNW	0.0	NNW	Southwest	0.7	0	0.7
5/7/2013	0.4	N	1.5	NE	0.6	NE	Southwest	1.5	0.5	1
5/10/2013	0.0	NW	0.3	NNW	0.0	NNW	Southwest	0.3	0	-0.3
5/13/2013	0.4	WNW	0.4	NE	0.0	NE	Southwest	0.4	0.2	0.2
5/16/2013	0.6	N	1.1	NE	0.5	NNE	Southwest	1.1	0.55	0.55
5/19/2013	0.0	WNW	1.1	WSW	0.0	WSW	Northeast	0	0.55	-0.55
5/22/2013	0.0	NNW	1.5	NNW	0.0	NNW	Southwest	1.5	0	1.5
5/25/2013	0.0	WNW	0.0	ENE	0.0	ENE	Southwest	0	0	0
5/28/2013	0.0	NNW	0.5	WNW	0.0	WNW	Southwest	0.5	0	0.5
5/31/2013	0.0	WNW	0.6	ENE	0.0	ENE	Southwest	0.6	0	0.6
6/3/2013	0.0	NE	0.0	NE	0.0	NE	Southwest	0	0	0
6/6/2013	0.0	NNW	0.0	NW	0.4	NW	Northeast	0.4	0	0.4
6/9/2013	0.0	NNE	1.0	WNW	0.0	WNW	Southwest	1	0	1
6/12/2013	0.0	N	0.8	SW	0.0	SW	Northeast	0	0.4	-0.4
6/15/2013	0.0	WNW	0.0	ENE	0.5	ENE	Southwest	0	0.25	-0.25
6/18/2013	0.0	NNW	0.8	NW	0.0	NW	Southwest	0.8	0	0.8
6/21/2013	0.0	SE	1.0	ENE	0.0	ENE	Southwest	1	0	1
6/24/2013	0.4	NW	0.6	NW	0.4	ESE	Southwest	0.6	0.4	0.2
6/27/2013	0.0	SE	0.6	SE	0.5	SE	In-Town	0	0.55	-0.55
6/30/2013	0.0	NNE	1.0	NW	0.0	NW	Southwest	1	0	1
7/3/2013	0.0	NNE	0.0	NE	0.0	NE	Southwest	0	0	0
7/6/2013	0.7	WNW	1.8	E	0.5	E	Southwest	1.8	0.6	1.2

Table 3-2 (Continued). Ambient PM4 Crystalline Silica Data										
Date	In-Town		Southwest		Northeast		Downwind		Back-Ground	Difference
	PM4 CS μg/M3	Wind Dir.	PM4 CS μg/M3	Wind Dir	PM4 CS μg/M3	Wind Dir	Site	PM4 CS μg/M3	PM4 CS μg/M3	PM4 CS μg/M3
7/9/2013	0.0	SE	0.0	SE	0.0	SE	In-Town	0	0	0
7/12/2013	0.4	WNW	1.2	S	0.3	S	In-Town	0.4	0.75	-0.35
7/15/2013	0.0	NE	0.0	ESE	0.0	ESE	In-Town	0	0	0
7/18/2013	0.3	S	0.4	WSW	0.9	S	Northeast	0.9	0.35	0.55
7/21/2013	0.0	NNW	0.6	NW	0	NE	Southwest	0.6	0	0.6
7/24/2013	0.0	N	0.0	ENE	0	NNE	Southwest	0	0	0
7/27/2013	0.0	SE	1.5	ENE	0	WSW	Southwest	1.5	0	1.5
7/30/2013	0.0	N	0.3	ENE	1.3	NNE	Southwest	0.3	0.65	-0.35
8/2/2013	0.0	N	1.3	ENE	0	W	Southwest	1.3	0	1.3
8/5/2013	0.0	WNW	0.0	ENE	0.4	NE	Southwest	0	0.2	-0.2
8/8/2013	0.0	NNE	0.0	ENE	0	WSW	Southwest	0	0	0
8/11/2013	0.0	WNW	0.5	WNW	0	NNE	Southwest	0.5	0	0.5
8/14/2013	0.0	NNE	0.4	ENE	0	NNE	Southwest	0.4	0	0.4
8/17/2013	0.0	WNW	0.3	NNE	0.3	NE	Southwest	0.3	0.15	0.15
8/20/2013	0.4	WNW	1.5	WNW	0.4	SSE	Southwest	1.5	0.4	1.1
8/23/2013	0.0	NNE	0.7	ENE	0.0	NNE	Southwest	0.7	0	0.7
8/26/2013	0.4	NW	0.4	WSW	0.6	S	Northeast	0.6	0.4	0.2
8/29/2013	0.0	NNE	0.6	E	0.3	SSE	Southwest	0.6	0.15	0.45
9/1/2013	0.0	SE	1.4	ENE	0.0	W	Southwest	1.4	0	1.4
9/4/2013	0.4	N	0.7	ENE	0.6	NNE	Southwest	0.7	0.5	0.2
9/7/2013	0.6	NNE	0.9	NW	1.0	NNE	Southwest	0.9	0.8	0.1
9/10/2013	0.0	SE	0.4	SW	0.4	WSW	Northeast	0.4	0.2	0.2
9/13/2013	0.0	N	0.0	ENE	0.0	NNE	Southwest	0	0	0
9/16/2013	0.0	WNW	0.0	ENE	0.0	NNE	Southwest	0	0	0
9/19/2013	0.0	NNE	0.9	NW	0.0	SSE	Southwest	0.9	0	0
9/22/2013	ND1	N	0.0	ENE	0.0	ENE	Southwest	0	0	0
9/25/2013	0.0	WNW	0.0	ENE	0.0	NNE	Southwest	0	0	0
9/28/2013	0.0	WNW	0.0	SW	0.0	SE	Southwest	0	0	0
10/1/2013	0.0	SE	0.0	WSW	0.0	SW	Northeast	0	0	0
10/4/2013	0.0	NNW	0.0	NW	0.0	NNE	Southwest	0	0	0
10/7/2013	0.0	N	0.0	WSW	0.0	WSW	Northeast	0	0	0
10/10/2013	0.0	NNE	0.0	ENE	0.0	ESE	Southwest	0	0	0
10/13/2013	0.0	N	0.0	ENE	0.0	SW	Southwest	0	0	0
10/16/2013	0.0	SE	0.0	ENE	0.0	W	Southwest	0	0	0
10/19/2013	0.0	SSW	0.6	SW	0.0	SSW	Northeast	0	0.3	-0.3
10/22/2013	0.0	N	0.3	ENE	0.0	SW	Southwest	0.3	0	0.3
10/25/2013	0.0	NNE	0.0	SW	0.0	SW	Northeast	0	0	0
10/28/2013	0.0	NNW	0.0	NNW	0.0	NNE	Southwest	0	0	0
10/31/2013	0.0	SE	0.3	WSW	0.0	SW	Northeast	0	0.15	-0.15
11/3/2013	0.0	WNW	0.0	ENE	0.0	E	Southwest	0	0	0

Table 3-2 (Continued). Ambient PM4 Crystalline Silica Data										
Date	In-Town		Southwest		Northeast		Downwind		Back-Ground	Difference
	PM4 CS µg/M^3	Wind Dir.	PM4 CS µg/M^3	Wind Dir	PM4 CS µg/M^3	Wind Dir	Site	PM4 CS µg/M^3	PM4 CS µg/M^3	PM4 CS µg/M^3
11/6/2013	0.0	SE	0.0	WSW	0.0	SW	Northeast	0	0	0
11/9/2013	0.0	SE	0.0	WSW	0.0	WSW	Northeast	0	0	0
11/12/2013	0.0	SSW	0.8	SW	0.0	SW	Northeast	0	0.4	-0.4
11/15/2013	0.6	WNW	1.3	ENE	0.5	SSE	Southwest	1.3	0.55	0.75
11/18/2013	0.0	SE	0.4	WSW	0.0	W	Northeast	0	0.2	-0.2
11/21/2013	0.0	SE	0.0	SW	0.0	NW	Northeast	0	0	0
11/24/2013	0.4	SSW	0.5	SW	0.0	SSE	Northeast	0	0.45	-0.45
11/27/2013	0.5	WNW	0.6	ENE	0.0	SE	Southwest	0.6	0.25	0.35
11/30/2013	0.0	N	0.9	ENE	0.4	SW	Southwest	0.9	0.2	0.7
12/3/2013	0.0	NNW	0.4	NW	0.0	NE	Southwest	0.4	0	0.4
12/6/2013	0.0	SE	0.0	WSW	0.0	SW	Northeast	0	0	0
12/9/2013	0.0	SE	0.0	SW	0.0	SW	Northeast	0	0	0
12/12/2013	0.0	SSW	0.0	SW	0.0	SW	Northeast	0	0	0
12/15/2013	0.0	SE	0.0	NE	0.0	W	Southwest	0	0	0
12/18/2013	0.0	N	0.0	ENE	0.0	SW	Southwest	0	0	0
12/21/2013	0.0	NNW	0.7	NNW	0.0	NNE	Southwest	0.7	0	0.7
12/24/2013	0.0	WNW	0.0	SW	0.0	ESE	Southwest	0	0	0
12/27/2013	0.0	WNW	1.4	SW	0.0	SW	Northeast	0	0.7	-0.7
12/30/2013	0.0	WNW	0.0	W	0.0	E	Southwest	0	0	0
1/2/2014	0.0	N	0.6	ENE	0.0	NNW	Southwest	0.6	0	0.6
1/5/2014	0.0	SE	0.0	NE	0.0	WNW	Southwest	0	0	0
1/8/2014	0.0	N	0.6	NE	0.0	SW	Southwest	0.6	0	0
1/11/2014	0.0	SE	0.0	SW	0.0	WSW	Northeast	0	0	0
1/14/2014	0.0	SE	0.4	NE	0.0	WNW	Southwest	0.4	0	0
1/17/2014	0.0	SE	0.4	WSW	0.0	WNW	Northeast	0	0.2	-0.2
1/20/2014	0.0	NW	0.9	NNE	0.0	NNW	Southwest	0.9	0	0.9
1/23/2014	0.0	SE	0.0	NE	0.0	SW	Southwest	0	0	0
1/26/2014	0.0	SE	0.0	WSW	0.0	W	Northeast	0	0	0
1/29/2014	0.0	N	0.0	SW	0.0	SSE	Southwest	0	0	0
2/1/2014	0.0	SE	0.0	NE	0.0	SW	Southwest	0	0	0
2/4/2014	0.0	NNW	1.3	NE	0.4	NNE	Southwest	1.3	0.2	1.1
2/7/2014	0.0	N	0.0	SW	0.5	SSW	Northeast	0.5	0	0.5
2/10/2014	0.0	NNW	0.0	SE	0.0	SW	Southwest	0	0	0
2/13/2014	0.0	ESE	0.0	SW	0.0	SW	Northeast	0	0	0
2/16/2014	0.0	NNW	0.0	WNW	0.0	NE	Southwest	0	0	0
2/19/2014	0.0	W	0.8	ENE	0.0	ESE	Southwest	0.8	0	0.8
2/22/2014	0.0	ESE	0.0	CALM	0.0	SW	Northeast	0	0	0
2/25/2014	0.0	ESE	0.0	WSW	0.0	WSW	Northeast	0	0	0
2/28/2014	0.0	W	0.4	NE	0.0	E	Southwest	0.4	0	0.4

Table 3-2 (Continued). Ambient PM4 Crystalline Silica Data										
Date	In-Town		Southwest		Northeast		Downwind		Back-Ground	Differ
	PM4 CS µg/M³	Wind Dir.	PM4 CS µg/M³	Wind Dir	PM4 CS µg/M³	Wind Dir	Site	PM4 CS µg/M³	PM4 CS µg/M³	PM4 CS µg/M³
3/3/2014	0	W	0	ENE	0	SW	Northeast	0	0	0
3/6/2014	0	W	0	SW	0	ESE	Northeast	0	0	0
3/9/2014	0	SSE	0	SW	0.7	SSE	Northeast	0.7	0	0.7
3/12/2014	0	SE	1.3	NNE	0	WNW	Southwest	1.3	0	1.3
3/15/2014	0	NW	1.1	NNE	0	NNE	Southwest	0	0	0
3/18/2014	0.5	NW	0.4	NNE	0.4	NE	Southwest	0.4	0.45	-0.05
Averages	0.13		0.45		0.06					

3.2 Contributions of WISC to Downwind PM4 Crystalline Silica Concentrations—The contribution of the emissions from WISC have been calculated in Table 3-2 (column on right). The downwind concentration has been determined based on an evaluation of the wind directional data at each sampling site. The background concentrations have been calculated using the arithmetic average of the measured values at the other two sampling locations. The results are summarized in Figure 3-1.

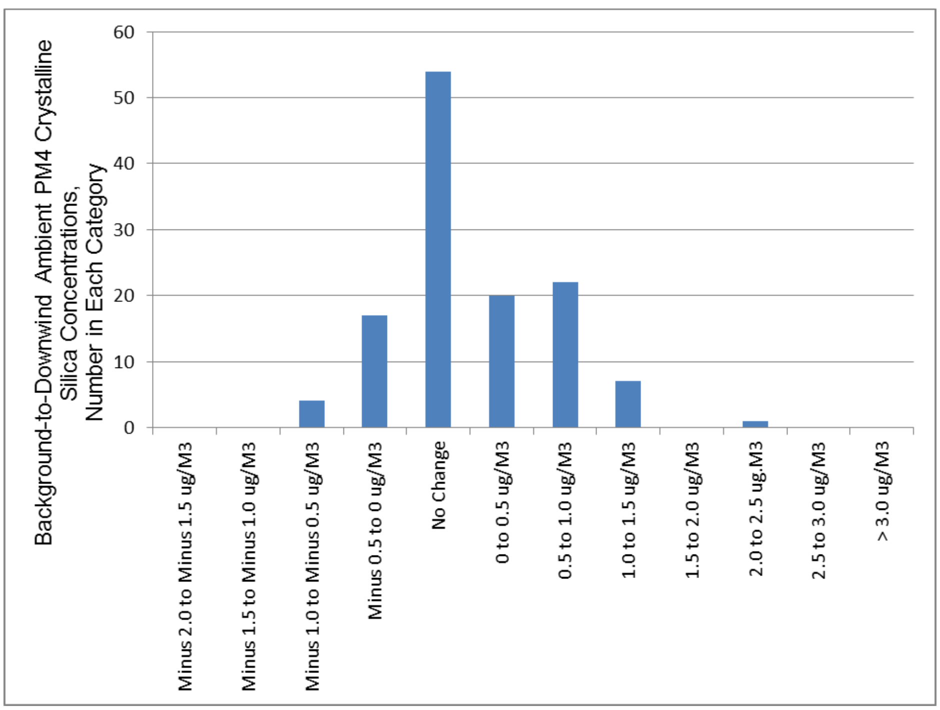

Figure 3-1. Background-to-Downwind PM4 Crystalline Silica Concentration Changes

Most of the background-to-downwind concentration differences are due to the method precision limitations at the very low PM4 crystalline silica concentrations measured in this sampling program. Some of the difference values greater than plus 1 µg/M³ are due, in part, to the contributions of the WISC emissions. These data demonstrate that the contribution of WISC to downwind concentrations is low and are probably typical of the contributions from the emissions of a diverse set of sources such as agricultural operations, unpaved roads, construction activity, industrial sources, sand on snow and ice-covered roads, and global transport of desert dusts.

3.3 Background Concentrations of PM4 Crystalline Silica—A significant portion of the measured ambient PM4 crystalline silica values above the LOQ are due to variations in the regional background concentrations. This is indicated by the variations in the background concentrations calculated in Table 3-2. The importance of variations in the PM4 crystalline silica background levels are also indicated by clusters of data summarized in Table 3-3. During some sampling days, at least two of the three, and often all three, sampling locations report concentrations above the LOQ. Due to the geographical configuration of these samplers, only one can be in a downwind position. Accordingly, the values detected at the other locations are due to regional background levels.

Table 3-3. Clusters of Above LOQ Concentrations at Numerous Sampling Locations

Sampling Date	In-Town, µg/M^3	Southwest µg/M^3	Northeast µg/M^3	Average µg/M^3
Days with above LOQ values at all three sampling locations				
2013-JUL-06	0.69	1.75	0.50	0.98
2013-JUL-12	0.44	1.19	0.31	0.65
2013-JUL-18	0.31	0.38	0.87	0.52
2013-AUG-17	0.00	0.31	0.31	0.21
2013-AUG-20	0.38	1.51	0.44	0.78
2013-AUG-26	0.44	0.37	0.56	0.46
2013-SEP-04	0.44	0.75	0.56	0.58
2013-SEP-07	0.63	0.88	1.00	0.84
Days with most measured concentrations at or below the LOQ at two or three sampling locations				
Sampling Date	In-Town, µg/M^3	Southwest µg/M^3	Northeast µg/M^3	Average µg/M^3
2013-JUL-03	0.00	0.00	0.00	0.00
2013-JUL-09	0.00	0.00	0.00	0.00
2013-JUL-15	0.00	0.00	0.00	0.00
2013-JUL-21	0.00	0.56	0.00	0.19
2013-JUL-24	0.00	0.00	0.00	0.00
2013-AUG-02	0.00	1.32	0.00	0.44
2013-AUG-05	0.00	0.00	0.38	0.13
2013-AUG-08	0.00	0.00	0.00	0.00
2013-AUG-11	0.00	0.50	0.00	0.17
2013-AUG-14	0.00	0.38	0.00	0.13
2013-AUG-23	0.00	0.75	0.00	0.25
2013-SEP-01	0.00	1.44	0.00	0.48
2013-SEP-13	ND	0.00	0.00	0.00
2013-SEP-16	ND	0.00	0.00	0.00

These data suggest background concentrations in the range of 0.4 to 1.0 ug/M3 during some sampling days.

3.4 PM4 Particulate Matter Concentrations as a Surrogate for PM2.5 Particulate Matter— The PM4 particulate matter concentration data provide a useful surrogate for PM2.5 particulate matter concentrations because the PM4 size range includes (1) all particulate matter between 0 and 2.5 micrometers, plus (2) all particulate matter between 2.5 and 4.0 micrometers. Accordingly, PM4 particulate matter is a more inclusive size category.

The ambient PM4 concentration data shown in Figure 3-2 and listed in Table 3-4 correspond well with the ambient PM2.5 concentrations measured by the Wisconsin Department of Natural Resources (DNR) at a site in Eau Claire approximately 45 miles from Maiden Rock, Wisconsin. As indicated in Figure 3-2, there is remarkable consistency in the trends in the concentrations of PM4 particulate matter at the three community orientated sampling locations around the Maiden Rock underground mine and processing plant, and the PM2.5 concentrations at the DNR site.

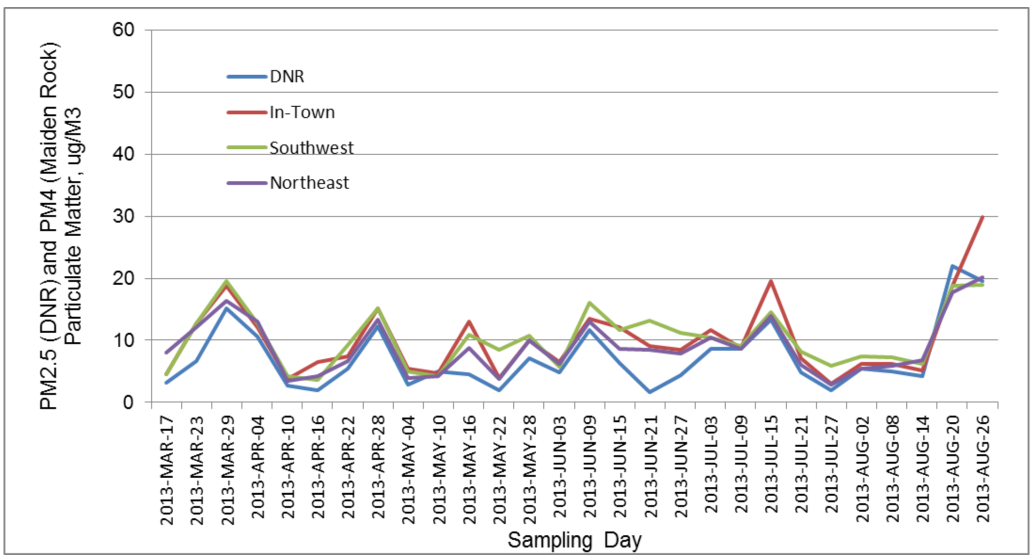

Figure 3-2. Comparison of the Maiden Rock PM4 Concentrations and the DNR PM2.5 Concentrations

As indicated in Figure 3-2, the PM4 particulate matter concentrations are slightly higher than the DNR PM2.5 concentrations. This is expected considering that (1) the PM4 size range includes a broader set of particle sizes than the PM2.5 size range, (2) PM4 particulate matter emissions from a major rail line running north and south on the west side of the WISC facility contribute to the observed PM4 particulate matter concentrations, (3) WISC has small PM4 particulate matter emissions, (4) motor vehicle emissions from boats on the Mississippi river and traffic on State Road 35 are carried into the valley when the wind are from the northwest, west, and southwest, and (5) agricultural activities and open burning in residences to the east of the facility are carried into the valley when the winds are from the north, northeast, and east.

Table 3-4. Ambient PM4 Particulate Matter Data										
Date	In-town		Southwest		Northeast		Downwind		Back-Ground	Difference
	PM4 μg/M^3	Wind Dir.	PM4 μg/M^3	Wind Dir	PM4 μg/M^3	Wind Dir	Site	PM4 μg/M^3	PM4 μg/M^3	PM4 μg/M^3
3/11/2013	3.9	ENE	8.7	ESE	7.9	ND	Southwest	8.7	5.9	2.8
3/14/2013	14.8	NW	14.71	SSW	23.07	WSW	Northeast	23.07	14.7	8.34
3/17/2013	4.6	WNW	4.51	WNW	8.02	ESE	Northeast	8.02	4.5	3.49
3/20/2013	5.5	SE	4.81	SW	0.44	WNW	Northeast	0.44	5.1	-4.71
3/23/2013	12.8	N	12.75	WSW	12.04	NE	Southwest	12.75	12.4	0.34
3/26/2013	8.2	N	9.54	WNW	7.52	W	Northeast	7.52	8.9	-1.33
3/29/2013	18.8	N	19.59	NNE	16.33	SSE	Southwest	19.59	17.5	2.04
4/1/2013	4.6	SE	5.76	NE	4.13	WNW	Southwest	5.76	4.3	1.42
4/4/2013	12.2	SSW	12.66	SSW	12.99	SSW	Northeast	12.99	12.4	0.59
4/7/2013	12.6	SE	13.22	NE	11.47	SW	Northeast	11.47	12.9	-1.44
4/10/2013	3.8	WNW	4.31	NNW	3.45	NNE	Southwest	4.31	3.6	0.67
4/13/2013	4.5	SE	5.33	WSW	2.50	SW	Northeast	2.50	4.9	-2.41
4/16/2013	6.5	SE	3.69	SW	4.31	WSW	Northeast	4.31	5.1	-0.78
4/19/2013	2.0	SE	3.75	NE	2.57	W	Southwest	3.75	2.3	1.46
4/22/2013	7.4	NNW	9.31	SSW	6.61	NNW	Northeast	6.61	8.4	-1.74
4/25/2013	8.4	SE	9.87	SW	5.12	SW	Northeast	5.12	9.2	-4.04
4/28/2013	15.2	WNW	15.09	ENE	13.32	SE	Southwest	15.09	14.2	0.85
5/1/2013	5.6	ENE	9.16	NE	4.38	WNW	Southwest	9.16	5.0	4.18
5/4/2013	5.5	NNW	4.99	NNW	3.89	NNW	Southwest	4.99	4.7	0.29
5/7/2013	14.2	N	14.47	NE	11.88	NE	Southwest	14.47	13.0	1.45
5/10/2013	4.6	NW	4.19	NNW	4.18	NNW	Southwest	4.19	4.4	-0.21
5/13/2013	6.5	WNW	8.07	NE	5.74	NE	Southwest	8.07	6.1	1.95
5/16/2013	13.0	N	10.96	NE	8.82	NNE	Southwest	10.96	10.9	0.06
5/19/2013	14.9	WNW	17.57	WSW	16.53	WSW	Northeast	16.53	16.2	0.31
5/22/2013	3.9	NNW	8.43	NNW	3.76	NNW	Southwest	8.43	3.9	4.58
5/25/2013	8.0	WNW	6.56	ENE	7.78	ENE	Southwest	6.56	7.9	-1.34
5/28/2013	10.0	NNW	10.72	WNW	10.07	WNW	Southwest	10.72	10.0	0.69
5/31/2013	6.3	WNW	9.50	ENE	5.39	ENE	Southwest	9.50	5.8	3.67
6/3/2013	6.4	NE	5.81	NE	6.27	NE	Southwest	5.81	6.4	-0.54
6/6/2013	17.2	NNW	11.17	NW	12.54	NW	Northeast	12.54	14.2	-1.65
6/9/2013	13.6	NNE	15.99	WNW	13.01	WNW	Southwest	15.99	13.3	2.71
6/12/2013	16.6	N	14.27	SW	11.11	SW	Northeast	11.11	15.5	-4.35
6/15/2013	12.1	WNW	11.60	ENE	8.62	ENE	Southwest	11.60	10.3	1.26
6/18/2013	8.3	NNW	12.54	NW	7.46	NW	Southwest	12.54	7.9	4.68
6/21/2013	9.1	SE	13.12	ENE	8.49	ENE	Southwest	13.12	8.8	4.33
6/24/2013	10.2	NW	13.16	NW	8.86	ESE	Southwest	13.16	9.6	3.60
6/27/2013	8.5	SE	11.17	SE	7.88	SE	In-Town	8.5	9.5	-1.06
6/30/2013	14.6	NNE	16.24	NW	13.93	NW	Southwest	16.24	14.3	1.96
7/3/2013	11.7	NNE	10.47	NE	10.42	NE	Southwest	10.47	11.0	-0.57
7/6/2013	21.0	WNW	22.84	E	19.02	E	Southwest	22.84	20.0	2.80

Table 3-4. Ambient PM4 Particulate Matter Data										
Date	In-town		Southwest		Northeast		Downwind		Back-Ground	Differ
	PM4 µg/M^3	Wind Dir.	PM4 µg/M^3	Wind Dir	PM4 µg/M^3	Wind Dir	Site	PM4 µg/M^3	PM4 µg/M^3	PM4 µg/M^3
7/9/2013	8.8	SE	9.16	SE	8.58	SE	In-Town	8.8	8.9	-0.11
7/12/2013	17.9	WNW	18.30	S	16.97	S	In-Town	17.9	17.6	0.24
7/15/2013	19.5	NE	14.60	ESE	13.92	ESE	In-Town	19.5	14.3	5.22
7/18/2013	15.9	S	16.02	WSW	13.86	S	Northeast	13.86	16.0	-2.11
7/21/2013	7.1	NNW	8.18	NW	6.08	NE	Southwest	8.18	6.6	1.60
7/24/2013	4.3	N	3.50	ENE	24.06	NNE	Southwest	3.50	14.2	-10.65
7/27/2013	3.0	SE	5.87	ENE	2.81	WSW	Southwest	5.87	2.9	2.96
7/30/2013	8.8	N	8.96	ENE	13.76	NNE	Southwest	8.96	11.3	-2.33
8/2/2013	6.3	N	7.40	ENE	5.45	W	Southwest	7.40	5.9	1.54
8/5/2013	7.4	WNW	19.73	ENE	7.31	NE	Southwest	19.73	7.3	12.38
8/8/2013	6.2	NNE	7.32	ENE	5.86	WSW	Southwest	7.32	6.1	1.26
8/11/2013	7.3	WNW	7.83	WNW	6.07	NNE	Southwest	7.83	6.7	1.17
8/14/2013	5.1	NNE	6.20	ENE	6.76	NNE	Southwest	6.20	5.9	0.29
8/17/2013	11.2	WNW	10.25	NNE	11.35	NE	Southwest	10.25	11.3	-1.02
8/20/2013	18.8	WNW	18.82	WNW	17.80	SSE	Southwest	18.82	18.3	0.52
8/23/2013	6.5	NNE	8.23	ENE	6.44	NNE	Southwest	8.23	6.5	1.78
8/26/2013	29.8	NW	18.99	WSW	20.10	S	Northeast	20.10	24.4	-4.31
8/29/2013	15.0	NNE	13.00	E	12.69	SSE	Southwest	13.00	13.8	-0.85
9/1/2013	6.7	SE	7.39	ENE	5.63	W	Southwest	7.39	6.2	1.23
9/4/2013	12.5	N	8.75	ENE	8.34	NNE	Southwest	8.75	10.4	-1.66
9/7/2013	14.3	NNE	14.36	NW	15.33	NNE	Southwest	14.36	14.8	-0.44
9/10/2013	7.4	SE	8.45	SW	6.76	WSW	Northeast	6.76	7.9	-1.19
9/13/2013	2.3	N	0.81	ENE	0.19	NNE	Southwest	0.81	1.2	-0.44
9/16/2013		WNW	1.44	ENE	-0.13	NNE	Southwest	1.44	-0.1	1.50
9/19/2013	11.3	NNE	15.07	NW	10.04	SSE	Southwest	15.07	10.7	4.41
9/22/2013		N	3.43	ENE	2.07	ENE	Southwest	3.43	1.0	2.39
9/25/2013	9.9	WNW	8.42	ENE	8.03	NNE	Southwest	8.42	9.0	-0.55
9/28/2013	9.2	WNW	8.83	SW	8.14	SE	Southwest	8.83	8.6	0.18
10/1/2013	4.8	SE	6.08	WSW	4.07	SW	Northeast	4.07	5.4	-1.38
10/4/2013	4.8	NNW	5.49	NW	4.24	NNE	Southwest	5.49	4.5	0.99
10/7/2013	3.4	N	5.18	WSW	-0.69	WSW	Northeast	-0.69	4.3	-5.01
10/10/2013	9.6	NNE	8.45	ENE	5.62	ESE	Southwest	8.45	7.6	0.82
10/13/2013	2.1	N	3.57	ENE	5.07	SW	Southwest	3.57	3.6	0.00
10/16/2013	2.8	SE	3.26	ENE	0.63	W	Southwest	3.26	1.7	1.57
10/19/2013	2.8	SSW	3.45	SW	2.26	SSW	Northeast	2.26	3.1	-0.87
10/22/2013	1.6	N	2.25	ENE	0.94	SW	Southwest	2.25	1.3	0.97
10/25/2013	6.3	NNE	5.38	SW	6.25	SW	Northeast	6.25	5.9	0.39
10/28/2013	1.8	NNW	1.00	NNW	0.81	NNE	Southwest	1.00	1.3	-0.28
10/31/2013	8.4	SE	8.78	WSW	7.33	SW	Northeast	7.33	8.6	-1.28
11/3/2013	2.2	WNW	4.19	ENE	3.31	E	Southwest	4.19	2.7	1.44

Table 3-4. Ambient PM4 Particulate Matter Data										
Date	In-town		Southwest		Northeast		Downwind		Back-Ground	Differ
	PM4 µg/M^3	Wind Dir.	PM4 µg/M^3	Wind Dir	PM4 µg/M^3	Wind Dir	Site	PM4 µg/M^3	PM4 µg/M^3	PM4 µg/M^3
11/6/2013	5.5	SE	5.12	WSW	3.50	SW	Northeast	3.50	5.3	-1.82
11/9/2013	2.6	SE	2.87	WSW	3.89	WSW	Northeast	3.89	2.7	1.17
11/12/2013	2.1	SSW	4.75	SW	3.82	SW	Northeast	3.82	3.4	0.38
11/15/2013	12.2	WNW	9.92	ENE	10.49	SSE	Southwest	9.92	11.3	-1.41
11/18/2013	3.1	SE	1.56	WSW	1.50	W	Northeast	1.50	2.3	-0.85
11/21/2013	13.9	SE	13.56	SW	8.34	NW	Northeast	8.34	13.7	-5.40
11/24/2013	5.3	SSW	5.76	SW	2.44	SSE	Northeast	2.44	5.5	-3.10
11/27/2013	3.5	WNW	3.45	ENE	0.75	SE	Southwest	3.45	2.1	1.32
11/30/2013	16.5	N	20.09	ENE	19.46	SW	Southwest	20.09	18.0	2.11
12/3/2013	9.7	NNW	11.47	NW	12.33	NE	Southwest	11.47	11.0	0.47
12/6/2013	6.6	SE	4.55	WSW	2.12	SW	Northeast	2.12	5.6	-3.43
12/9/2013	8.0	SE	9.93	SW	8.35	SW	Northeast	8.35	9.0	-0.64
12/12/2013	9.4	SSW	10.49	SW	10.10	SW	Northeast	10.10	10.0	0.13
12/15/2013	2.2	SE	3.74	NE	4.62	W	Southwest	3.74	3.4	0.33
12/18/2013	7.9	N	0.00	ENE	0.00	SW	Southwest	0.00	3.9	-3.93
12/21/2013	0.0	NNW	7.43	NNW	7.34	NNE	Southwest	7.43	3.7	3.76
12/24/2013	15.4	WNW	8.33	SW	6.26	ESE	Southwest	8.33	10.8	-2.50
12/27/2013	12.6	WNW	16.39	SW	8.12	SW	Northeast	8.12	14.5	-6.36
12/30/2013	10.2	WNW	12.23	W	9.39	E	Southwest	12.23	9.8	2.43
1/2/2014	0.0	N	6.92	ENE	0.00	NNW	Southwest	6.92	0.0	6.92
1/5/2014	0.0	SE	0.00	NE	0.00	WNW	Southwest	0.00	0.0	0.00
1/8/2014	11.2	N	6.44	NE	0.00	SW	Southwest	6.44	5.6	0.83
1/11/2014	15.9	SE	14.64	SW	13.11	WSW	Northeast	13.11	15.3	-2.15
1/14/2014	0.0	SE	0.00	NE	7.14	WNW	Southwest	0.00	3.6	-3.57
1/17/2014	2.7	SE	3.1	WSW	2.1	WNW	Northeast	3.10	2.4	0.7
1/20/2014	1.4	NW	177.3	NNE	1.5	NNW	Southwest	177.3	1.45	175.85
1/23/2014	0.6	SE	1.5	NE	1.1	SW	Southwest	1.5	0.85	0.65
1/26/2014	0.7	SE	1.4	WSW	-1.6	W	Northeast	-1.60	1.1	-2.65
1/29/2014	1.9	N	2.1	SW	3.4	SSE	Southwest	2.1	2.65	-0.55
2/1/2014	11.2	SE	9.3	NE	8.9	SW	Southwest	9.3	10.05	-0.75
2/4/2014	16	NNW	17.3	NE	12	NNE	Southwest	17.3	14	3.3
2/7/2014	1.2	N	1.5	SW	2.2	SSW	Northeast	2.20	1.4	0.85
2/10/2014	6.4	NNW	7.4	SE	5.9	SW	Southwest	7.4	6.15	1.25
2/13/2014	16.7	ESE	16.8	SW	15	SW	Northeast	15.00	16.8	-1.75
2/16/2014	4.9	NNW	3.8	WNW	2.9	NE	Southwest	3.8	3.9	-0.1
2/19/2014	7.6	W	7.1	ENE	8.3	ESE	Southwest	7.1	7.95	-0.85
2/22/2014	-1	ESE	-0.8	CALM	-0.4	SW	Northeast	-0.40	-0.9	0.50
2/25/2014	4	ESE	176.2	WSW	3.1	WSW	Northeast	3.10	90.1	-87.00
2/28/2014	10	W	8.7	NE	9.2	E	Southwest	8.7	9.6	-0.9

Table 3-4. Ambient PM4 Particulate Matter Data										
Date	In-town		Southwest		Northeast		Downwind		Back-Ground	Differ
	PM4 µg/M^3	Wind Dir.	PM4 µg/M^3	Wind Dir	PM4 µg/M^3	Wind Dir	Site	PM4 µg/M^3	PM4 µg/M^3	PM4 µg/M^3
3/3/2014	7.8	W	7.4	ENE	6.9	SW	Northeast	6.90	7.6	-0.70
3/6/2014	17.6	W	18	SW	15.7	ESE	Northeast	15.70	17.8	-2.10
3/9/2014	7.1	SSE	7.2	SW	6.3	SSE	Northeast	6.30	7.2	-0.85
3/12/2014	0	SE	0	NNE	0	WNW	Southwest	0	0	0
3/15/2014	0	NW	0	NNE	0	NNE	Southwest	0	0	0
3/18/2014	16.9	NW	18.9	NNE	17	NE	Southwest	18.9	16.95	1.95
Averages	8.3		11.4		7.3					

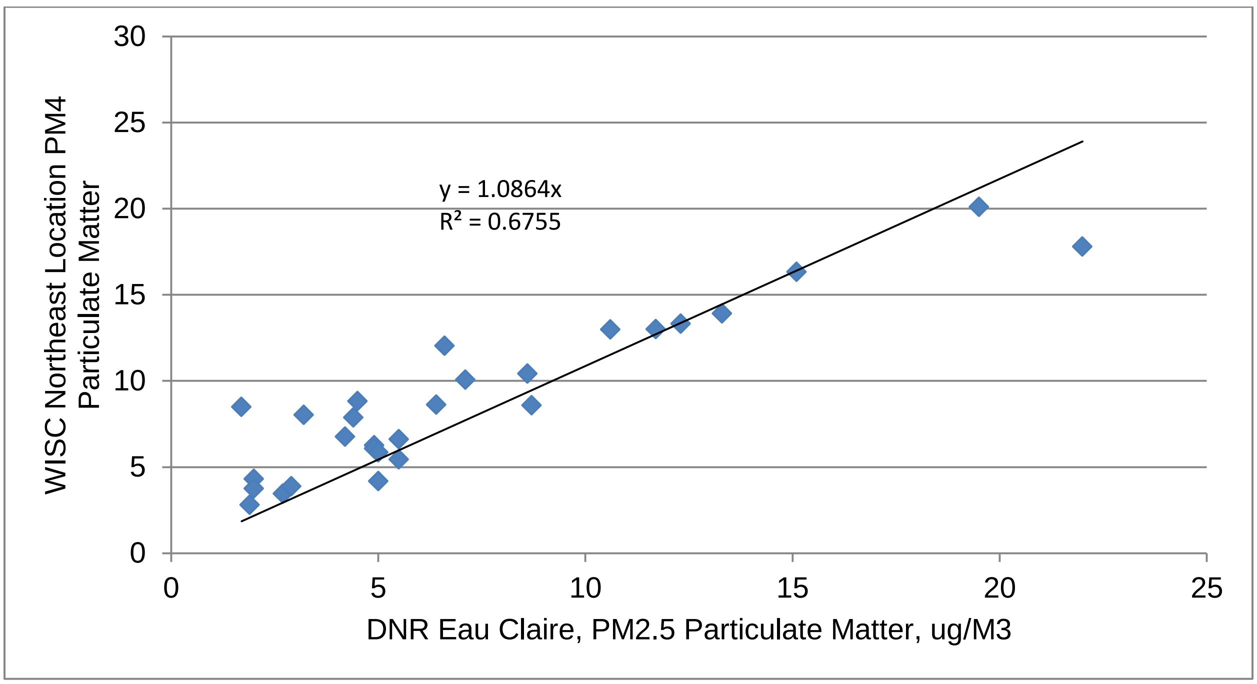

Figure 3-3. Correlation Between the WISC Northeast sampling location– Maiden Rock PM_4 Concentration Data and The Nearest Wisconsin DNR $PM_{2.5}$ Sampling Location Concentration Data

As indicated in Figure 3-3, there is a relatively high correlation coefficient of 0.67 between the WISC northeast sampling location PM4 particulate matter data and the DNR PM2.5 particulate matter data measured 45 miles to the north in Eau Claire. This is high correlation coefficient for two sets of data obtained far apart, measured in areas with remarkably different topography, measured with different samplers, and operated by different organizations. The high correlation was not surprising considering that (1) PM2.5 particulate matter is a major part of the PM4 size range, and (2) the WISC plant has low emissions of particulate matter in the PM4 size range. These data are also consistent with the very low PM4 crystalline silica concentrations measured throughout this year-long sampling program.

3.5 Conclusions—The PM4 crystalline silica concentration data and the PM4 particulate matter data compiled during this sampling program demonstrate that (1) the PM4 crystalline silica concentrations are low in community areas surrounding the WISC facility, (2) WISC does not contribute significantly to ambient PM4 crystalline silica levels, (3) regional background concentrations of ambient PM4 crystalline silica are responsible for many of the measured values above the LOQ level, and (4) PM4 particulate matter levels demonstrate that PM2.5 concentrations are low.

4. QUALITY ASSURANCE

WISC used quality assurance procedures that exceeded the stringent requirements of 40 CFR Part 50, Appendix L and EPA's quality assurance guideline manual. The Partisol 2000i samplers used for PM4 crystalline silica sampling at WISC - Maiden Rock satisfied these requirements throughout the 2013-2014 study period.

4.1 Partisol 2000i Sampler Performance

The Partisol 2000i tracks the sample flow rate, the coefficient of flow variation, the ambient air and filter temperatures, and the ambient air and filter atmospheric pressures on a continuous basis during the 24-hour sampling period. All three of the Partisol 2000i primary and collocated (duplicate) samplers achieved the required flow rate of 11.1 liters per minute, a coefficient of flow variation below the ±4% limit, ambient and filter temperature variations less than 2°C, and ambient and filter atmospheric pressure less than 10 mm mercury. The electronic tracking data are provided in Appendix H of this report.

4.2 Filter Blanks

The sampler operator installed and recovered a blank filter approximately every tenth sampling period. The results of the blank filter analyses are summarized in Table 4-1. These results demonstrate that the filters were not subject to contamination during filter loading, filter recovery, and laboratory analysis.

Table 4-1. Filter Blanks

Date	In-Town Sampler		Southwest Sampler		Northeast Sampler	
	Filter #	mg/filter	Filter #	mg/filter	Filter #	mg/filter
4/15/2013	207451	<LOQ	207450	<LOQ	207452	<LOQ
5/30/2013	207499	<LOQ	207500	<LOQ	207501	<LOQ
6/28/2013	207983	<LOQ	207984	<LOQ	207982	<LOQ
7/16/2013	208024	<LOQ	208022	<LOQ	208025	<LOQ
8/1/2013	208019	<LOQ	208021	<LOQ	208020	<LOQ
8/16/2013	208049	<LOQ	208050	<LOQ	208048	<LOQ
9/3/2013	208047	<LOQ	208075	<LOQ	208074	<LOQ

Table 4-1 (Continued). Filter Blanks						
Date	In-Town Sampler		Southwest Sampler		Northeast Sampler	
	Filter #	mg/filter	Filter #	mg/filter	Filter #	mg/filter
9/30/2013	208098	<LOQ	208100	<LOQ	208099	<LOQ
10/14/2013	208123	<LOQ	208125	<LOQ	208124	<LOQ
11/1/2013	214794	<LOQ	214792	<LOQ	214793	<LOQ
11/14/2013	214807	<LOQ	214809	<LOQ	214808	<LOQ
1/16/2014	214873	<LOQ	214875	<LOQ	214874	<LOQ
3/19/2014	219488	<LOQ	219490	<LOQ	219489	<LOQ

4.3 Routine Sampler Performance Verification and Sampler Calibration

In this sampling project, leak checks and sample flow audits were performed approximately every two weeks as indicated in Table 4-2. This is twice as frequent as guidelines provided by the instrument manufacturer and the U.S. EPA quality assurance manual. All three of the Partisol 2000i samplers met all of these quality assurance objectives. Audit data are provided in Appendix B of this report.

Table 4-2. Partisol 2000i Audit Dates		
Date	Organization/Personnel	Audit Status
6/22/2012	Thermo Scientific	Manufactures Calibration- Passed
11/11/2012	ACTPC/TTB	Audit / Passed, Calibration
3/13/2013	ACTPC/TTB	Audit / Passed
3/19/2013	WISC/MM	Audit / Passed
4/15/2013	WISC/MM	Audit / Passed
4/29/2013	WISC/MM	Audit / Passed
5/17/2013	WISC/MM	Audit / Passed
5/30/2013	ACTPC/TTB	Audit / Passed
6/28/2013	WISC/MM	Audit / Passed
7/16/2013	WISC/MM	Audit / Passed
8/1/2013	WISC/MM	Audit / Passed
8/11/2013	WISC/MM	Audit / Passed
9/3/2013	WISC/MM	Audit / Passed
9/17/2013	WISC/MM	Audit / Passed
9/17/2013	ACTPC/TTB	Audit / Passed, Calibration
9/30/2013	WISC/MM	Audit / Passed
10/14/2013	WISC/MM	Audit / Passed
11/1/2013	WISC/MM	Audit / Passed
11/14/2013	WISC/MM	Audit / Passed
12/3/2013	WISC/MM	Audit / Passed
12/16/2013	ACTPC/TTB	Audit / Passed
1/16/2014	WISC/MM	Audit / Passed
2/27/2014	WISC/MM	Audit / Passed
3/19/2014	WISC/MM	Audit / Passed

Air Control Techniques, P.C. conducted audits of all three samplers on November 11, 2012, March 13, 2013, May 30, 2013, September 17, 2013, and December 16, 2013. The audit data are recorded in Appendix B along with the calibration data (Appendix C) supplied by the instrument manufacturer when the samplers were purchased.

All of the quality assurance data demonstrate that the sampling results are accurate. The sampling and quality assurance auditing records are complete.

4.4 NIOSH Method 7500 Quality Assurance/Quality Control

Calibration standards were made by direct weighing of NIST 1878a, NIST 1879a, and NIOSH/ITRI tridymite reference materials onto silver membrane filters. A pure quartz sample was run to keep track of the X-ray intensity over time. These samples were used to determine if the instrument was faulty, or if the X-ray intensity had degraded enough to warrant a new X-ray tube.

Once every month, R. J. Lee conducted a resolution check of the instrument. The pure quartz sample was run to show the "five finger" region. The resulting diffraction pattern was compared with the previous month to determine if anything had changed with the instrument alignment. The instrument operated properly during all sample analyses.

Microbalances were calibrated daily by R. J. Lee using ASTM Class 1 calibration weights. Filters were pre-weighed, and the weights were stored in a database. Every tenth filter was re-weighed and compared to the previous result. The balance room was monitored daily for temperature and humidity.

All filter samples were recovered by the sampler operator using standard procedures specified in the Thermo Scientific Partisol 2000i manual, Chapter 3. All of the filter cassettes recovered following sampling were transported in a sealed case to prevent contamination during transport.

The filter cassette samples were packed in an appropriate shipping box and sealed. A chain of custody record and sample log were maintained during the sampling program. The R. J. Lee laboratory analysis sheets and the chain-of-custody sheets are reproduced in Appendix F.

5. REFERENCES

1. California Office of Environmental Health Hazards Assessment. “Chronic Toxicity Summary, Silica (Crystalline, Respirable).” February 2005.

2. Richards, J. and T. Brozell. “Ambient PM_4 Crystalline Silica Monitoring Method Development,” Preprint. 2012.

APPENDIX A.

IN-PLANT AND IN-TOWN DATA, AUGUST 2012 – MARCH 2013

Table A1. In-Plant and In-Town Data, August 2012 – March 2013			
	PM4 Crystalline Silica, µg/M^3		
Sampling Data	In-Town	In-Plant, Primary	In-Plant, Collocated
8/19/2012	0.0	0.0	0.0
8/21/2012	0.0	16.3	N/A
8/25/2012	0.4	4.1	N/A
8/28/2012	0.0	4.2	N/A
8/31/2012	0.0	5.4	N/A
9/3/2012	0.6	0.0	N/A
9/6/2012	0.4	9.9	9.3
9/12/2012	0.4	0.9	N/A
9/15/2012	0.4	3.8	N/A
9/18/2012	0.0	3.3	3.7
9/21/2012	0.0	4.2	N/A
9/24/2012	0.6	10.9	N/A
9/27/2012	0.0	3.0	N/A
9/30/2012	0.4	8.8	N/A
10/3/2012	0.5	12.4	N/A
10/6/2012	0.0	1.4	N/A
10/12/2012	0.0	3.8	N/A
10/18/2012	0.0	1.4	N/A
10/21/2012	0.0	11.6	12.0
10/24/2012	0.0	3.1	N/A
10/27/2012	0.0	3.4	3.4
10/30/2012	0.0	5.4	N/A
11/2/2012	0.0	2.8	N/A
11/5/2012	0.3	3.4	3.6
11/14/2012	0.3	ND	N/A
11/17/2012	0.4	ND	1.9
11/20/2012	0.0	7.6	N/A
11/23/2012	0.0	0.0	N/A
11/26/2012	0.0	1.2	N/A
11/29/2012	0.4	0.0	4.6
12/2/2012	0.3	4.3	N/A
12/5/2012	0.3	2.1	N/A
12/8/2012	0.0	2.8	N/A
12/11/2012	0.5	3.3	3.4
12/14/2012	0.6	3.8	N/A
12/17/2012	0.0	0.6	N/A
12/20/2012	0.0	1.6	N/A
12/23/2012	0.0	1.8	1.6

Table A1. In-Plant and In-Town Data, August 2012 – March 2013			
Sampling Data	PM4 Crystalline Silica, μg/M^3		
	In-Town	In-Plant, Primary	In-Plant, Collocated
12/26/2012	0.0	ND	N/A
12/29/2012	0.0	2.8	N/A
1/1/2013	0.0	0.0	0.0
1/4/2013	0.0	4.3	5.4
1/7/2013	0.4	2.9	N/A
1/10/2013	0.0	4.6	N/A
1/13/2013	0.0	0.0	N/A
1/16/2013	0.0	1.3	1.2
1/19/2013	0.0	2.8	N/A
1/22/2013	0.0	0.8	N/A
1/25/2013	0.0	1.5	N/A
1/28/2013	0.0	2.4	N/A
1/31/2013	0.0	0.9	0.5
2/3/2013	0.0	1.8	N/A
2/6/2013	0.0	3.1	N/A
2/9/2013	0.0	0.0	1.3
2/12/2013	0.0	0.6	N/A
2/15/2013	0.0	0.0	N/A
2/18/2013	0.0	0.0	N/A
2/21/2013	0.0	0.9	2.6
2/24/2013	0.3	1.0	N/A
2/27/2013	0.0	0.4	N/A
3/2/2013	0.0	ND	1.7
3/5/2013	0.0	0.8	1.3
3/8/2013	0.0	0.8	8.3