Particulate Pollution:

UW-Eau Claire Student Center and Chippewa Falls Sand Plant

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Purpose

The purpose of our research is to identify and address any potential hazards to public health caused by particulate matter in the air surrounding the construction site of the new UW-Eau Claire Student Center as well as at the Chippewa Falls Sand Plant.

Abstract

Air quality is an integral component of environmental and public health. Construction and industrial processes are known to degrade the clarity and quality of respirable air, and the existence of air particulates is directly correlated with respiratory disease, heart disease, and cancer. This research generates data from an on-campus fine particulate (PM2.5) monitor to assess air quality as the new student center is being built. Data from three additional monitors around, and one onsite at the EOG sand processing plant in Chippewa Falls are also analyzed, to answer the following questions: 1) Are particulate pollution levels generated from student center construction above the EPA 35 μg/m^3 24-hour or 15 μg/m^3 annual standards? 2) Are particulate levels at the sand plant construction site above these EPA levels? 3) Assuming 10% of particulate matter from the sand plant will be crystalline silica, are the current particulate monitors adequate to protect citizen health? This study benefits from collaboration of UW-Eau Claire faculty and students with the Concerned Chippewa Citizens community group and the Wisconsin Department of Natural Resources.

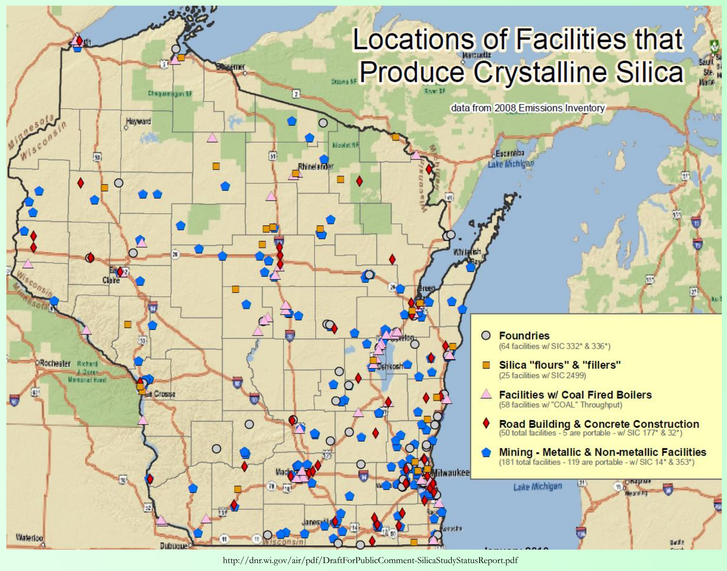
Background

Particulate matter (PM) is a term used to describe a complex group of air pollutants that vary in size and composition. The PM mixture of fine airborne solid particles and liquid droplets (aerosols) include components of nitrates, sulfates, elemental carbon (gasoline/diesel exhaust), organic carbon compounds, acid aerosols, trace metals, and geological material like crystalline silica, for example. Crystalline silica comes in three forms: quartz, tridymite, and cristobolite, with quartz being the most common. When respirable crystalline silica, in the form of particulate matter, is inhaled into the lungs it causes scarring of the alveoli and destroys macrophages. The body's mucociliary escalator is incapable of removing crystalline silica from the lungs. This eventually leads to silicosis, a chronic lung disease, induced by the inhalation of crystalline silica. After a latent period of varying duration, lung cancer can result. Crystalline silica is classified as a human carcinogen.

Table of EPA Standards

National Ambient Air Quality Standards for Particle Pollution		
Pollutant	**Primary Standards**	**Averaging Times**
Particulate Matter (PM_{10})	150 μg/m^3	24-hour
Particulate Matter ($PM_{2.5}$)	15.0 μg/m^3	Annual (Arithmatic Mean)
	35.0 μg/m^3	24-hour

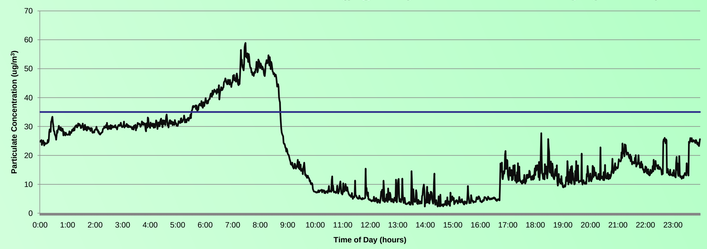
http://www.epa.gov/pm/standards.html



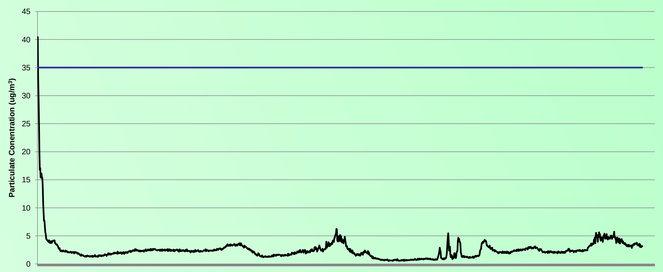
http://dnr.wi.gov/air/pdf/DraftForPublicComment-SilicaStudyStatusReport.pdf

Results

Particulate Concentration (μg/m^3) vs. Time of Day (hours)

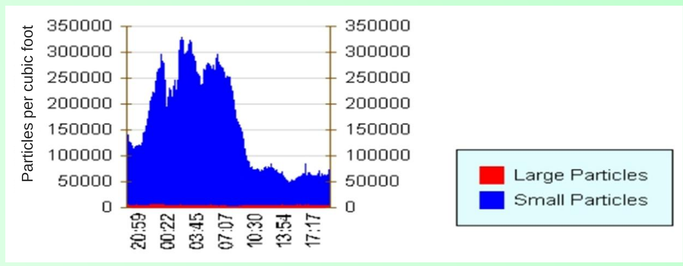


Mean particulate concentrations of $PM_{2.5}$ (μg/m^3) for three days over the course of a 24-hour period at UW-Eau Claire. Samples were taken using a Dylos air monitor on the southeast side of the Nursing building. The bold line represents the 24-hour EPA standard for $PM_{2.5,}$ which is 35 μg/m^3.



Particulate concentrations of $PM_{2.5}$ (μg/m^3) on September 7, 2010. Samples were taken using the Eagle Point Dylos air monitor; three miles south east of the Chippewa Falls sand plant. The bold line represents the 24-hour EPA standard for $PM_{2.5}$ which is 35 μg/m^3.

Particles Per Cubic Foot vs. Time of Day (hours)



The amount of particles measured by Eagle Point Dylos air monitor, located three miles SE of the Chippewa Falls sand plant. The time shown on the graph is between Sunday April 24th, 2011 – Monday April 25th, 2011. Courtesy of the Concerned Chippewa Citizens.

Student union construction; University-Wisconsin Eau Claire. Photo by Andrew Kleist.

Particulate Matter Distribution from Chippewa Falls Sand Plant

A map showing the distribution of modeled PM_{10} particulate matter concentrations from the Chippewa Falls sand processing plant. The diagram was created using, SCREEN3, an EPA recognized modeling software. There are four zones with estimated particulate matter concentrations, numbered accordingly. Zone 1 has a particulate matter concentration of 24.27 μg/m^3, zone 2 is 19.62 μg/m^3, zone 3 is 14.25 μg/m^3, and zone 4 is 10.98 μg/m^3.

Conclusion

Measured and modeled concentrations of particulate matter at UW-Eau Claire and the Chippewa Falls sand processing plant were found to be under national ambient air quality standards for particle pollution, established by the Environmental Protection Agency (EPA). Although the data suggest that there is not an immediate threat to public health posed by the particulate matter generated by the construction of the new student union at UW-Eau Claire and the Chippewa Falls sand processing plant, it is recommended that air quality monitoring is continued in order to ensure the health and safety of those exposed to particulates both on campus and surrounding the adjacent to the sand plant.

References

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